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COMMUNICATIONS

OBSERVATIONS ON SOME MATTERS ASSOCIATED WITH EXPERIMENTAL CORNEAL GRAFTING*

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CARDIFF

EXPERIMENTAL work on the eyes of rabbits has shown that whole thickness corneal tissue from another rabbit can be transplanted successfully, and that the grafts can remain transparent, when a particular technique is followed. Records of these experiments have been published.

It is proposed in this paper to supplement those records by some further records of homogeneous grafts, and to compare the results of homogeneous and heterogeneous grafts. The method of prevention of adhesion of the iris to a corneal graft will be discussed, and some observations will be made on the sensitiveness of corneal grafts, and on the clinical examination of an eye with an opaque cornea.

Homogeneous Grafts

Since the publication of a paper giving the results of corneal grafting, 11 experiments have been performed, using the technique which gives the best results.

* Richard Middlemore Post-Graduate Lecture delivered at the Birmingham and Midland Eye Hospital, on December 5, 1933.

Two of these have to be discounted; one died on the second day after the operation, the other was accidentally contaminated.

The results of the remaining nine are as follows:—

Five became transparent; one was nebulous with clear areas; one was nebulous throughout; one quite opaque; and one partly detached.

The five clear grafts were free from adhesion of the iris, with one exception where the iris was slightly adherent for the first fortnight, and then became free. The importance of keeping the iris free has been emphasized in previous papers. One of the animals died five weeks after the operation, the graft being practically clear, and there is no doubt it would have remained transparent had the animal lived.

The other four are still alive, at periods ranging from eight months to twenty-eight months from the date of the operation.

Photographs of these five grafts (hitherto unpublished) are included for publication with this paper. (Figs. 1 to 6.)

The nebulous graft with clear areas (Fig. 7) was free from adhesion of the iris, but about the end of the second week there was a small furrow around the graft which interfered with normal healing and perfect union. At no time was there a complete detachment at any portion of the margin; had there been even a small complete detachment, the graft would almost certainly have become opaque.

The two opaque grafts.—One of these was uniformly nebulous (Fig. 8). The graft in this rabbit united well, and the iris remained free. The development of opacity was mostly due to the behaviour of the animal which subjected the eye to much more strain and unrest than is usual in experimental animals, by its sudden and frequent jumping movements. The result of this extreme unrest was that the graft became somewhat prominent and convex, causing it to become opaque by the fifth week. The opacity diminished after some months, and the animal is still alive, 11 months after the operation with a uniformly nebulous graft.

The other opaque graft exhibited an adhesion of the iris to the cornea, from which source the graft became vascularized.

One graft became partly detached, and the animal was killed 11 days after the operation. There are two reasons to account for the failure in this case. One of the stitches penetrated the anterior chamber, so that the trephining had to be done on a soft eye. This resulted in damage to the lens, which developed cataract. The swelling lens helped to push the graft from its bed. The other reason for failure is that the intra-corneal portion of one of the stitches was too long, so that the adjoining margin of the graft was not securely held in place. The iris was adherent

FIG. 1 = R 128.
Three weeks after operation

FIG. 2 = R 128.
Two years and four months after operation.

FIG. 3 = R 156.
Nine months after operation.

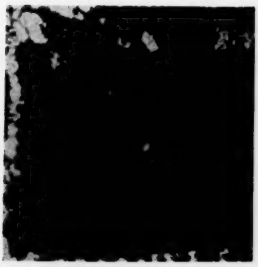


FIG. 4 = R 158.
Five weeks after operation.

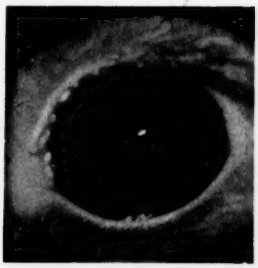


FIG. 5 = R 160
Eight months after operation.

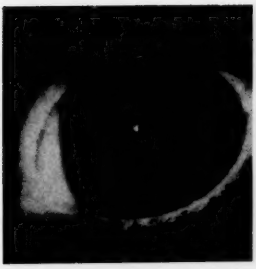


FIG. 6 = R 163.
Eight months after operation.

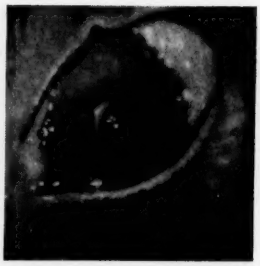


FIG. 7 = R 162.

Homogeneous corneal graft—nebulous with clear areas, eight months after operation.

FIG. 8 = R 151.

Homogeneous corneal graft—opaque, eleven months after operation.

FIG. 9 = R 137.

Heterogeneous corneal graft—opaque, seventeen months after operation.

FIG. 10 = R 159.

Heterogeneous corneal graft—uniformly nebulous, eight months after operation.

to the graft when the stitches were removed, and at that time there was no detachment. The swelling lens, however, soon broke down this early union, and the animal was then killed.

It has thus been possible to ascertain the causes of failure in cases where a transparent graft has not been obtained. These causes of failure are pitfalls that can be avoided in most cases if sufficient care is taken, and it is entirely useless to expect good results in corneal grafting unless meticulous attention is given to every detail.

The following is a summary of the results of the nine homogeneous grafts with seven others (previously published) operated on by the same technique, which was found to give the best results.

Of the 16 *homogeneous grafts*:—

10 were transparent.
1 had a clear area.
1 was nebulous with clear areas.
3 were opaque.
1 became partly detached.

This represents 62 per cent. clear grafts, and 75 per cent. which would allow useful vision.

Five Heterogeneous Grafts

One graft was taken from a human eye, and the other four were from cats' eyes.

All five became united, but none was clear.

Four were opaque, and in only one was there any suggestion of transparency; this one would be described as nebulous.

This brief summary of results needs to be qualified by reference to certain other facts.

The human cornea was kept for 19 hours before it was utilized for the experiment. This fact would have to be kept in mind as a possible cause of ultimate opacity even if the graft were taken from another rabbit. The graft was practically clear for the first week, but opacity began to develop about the end of the second week, and in the fourth week the graft became quite opaque. There was evident a slight rounding of the edges of the graft after about three weeks, and vascularization took place from the periphery of the cornea. The iris remained free, so that one prominent factor in the causation of opacity did not affect this case.

The graft was quite opaque when the animal died three months after the operation.

Four grafts taken from cats' eyes.—In three of these the iris was adherent, and the grafts were opaque. One has been observed for 17 months (Fig. 9), one was killed at two months, and one on the 15th day. The adhesion of the iris in each of these three cases would account for the development of opacity even in homogeneous grafts, so that one can not say definitely that these grafts would have become opaque if the iris had remained free.

The fourth of the grafts (Fig. 10) is more helpful in establishing the course of events. This graft united well, and the iris remained free. There was a slight tendency to retraction of the lower margin on the tenth day, and the graft was correspondingly slightly prominent. A milky opacity developed during the second week, followed by vascularization of the graft. At the end of four months the graft was still opaque, but by the seventh month the opacity had diminished so that the graft could be described as being nebulous. If this had been a homogeneous graft, it is most likely that union would have been very good, and with freedom from adhesion of the iris the graft would probably have been transparent.

It is therefore of interest to note that although 62 per cent. of homogeneous grafts become transparent, not one of this small series of heterogeneous grafts, operated on by the same technique, could be described as clear, while four out of the five were quite opaque.

Another observation worthy of note is the tendency that heterogeneous grafts have to become vascularized.

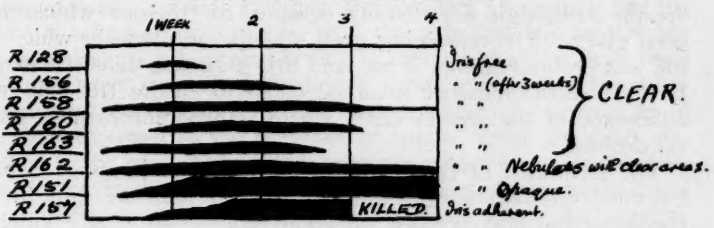
It is a fact that a homogeneous graft which unites well, and without complications, remains clear and avascular when a particular technique is followed.

Progress of Opacity in Homogeneous and Heterogeneous Grafts

The following chart (Fig. 11) indicates the presence and depth of opacity in these grafts subsequent to the operations. The numbers on the left of the chart refer to the rabbit concerned, and the space opposite each is blacked in according to the depth of the opacity, being left blank if the graft is clear, and completely blacked in if the graft is opaque. The chart shows the progress for the first four weeks, with a note as to the subsequent history. It will be seen that the clear homogeneous grafts all developed a cloudiness and slight opacity during the first week, which never led to complete opacity, and cleared up in the second to the fourth week. The heterogeneous grafts, on the other hand, although clear for a few days became cloudy, and in the second week became opaque, but in one of them the development of complete opacity took longer. They do not show the tendency to improvement

EIGHT HOMOGENEOUS GRAFTS

TABLE SHOWING DEPTH OF OPACITY



FIVE HETEROGENEOUS GRAFTS IN RABBITS

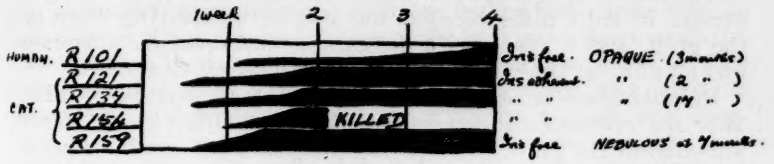


FIG. 11.

that is shown by the nebulous homogeneous graft with clear areas (R 162), which reached the height of its opacity about the second and third week. This graft (R 162) could be compared with the heterogeneous graft (R 159) inasmuch as they both united in a somewhat similar manner; in each case the iris remained free, and they were observed for eight months, and seven months respectively. The difference in the ultimate opacity of these two grafts was considerable, and leads one to the conclusion that this difference is due to the fact that one of them was taken from an animal of different species.

These observations lead to the conclusion that heterogeneous grafts should not be used for corneal transplantation when applied to man. Experiments on animals have shown that it is quite possible for these grafts to become united, but they do not become transparent. Homogeneous grafts can unite and remain transparent, both in experimental animals, and when applied to man.

The Prevention of Adhesion of the Iris to a Corneal Graft

Attention has been drawn in a previous paper to the deleterious effect of an adherent iris on the clarity of a corneal graft. Further proof of this statement is furnished by an examination of the eight united homogeneous grafts referred to in this paper. Six of these were free from any adhesion of the iris, and one other

exhibited a small adhesion of the iris which became free in three weeks. Five of these were clear, one had clear areas, one was opaque—although not densely opaque, for reasons which have been given. The remaining graft was the only one in which the iris was prominently adherent, and this graft was densely opaque. Every possible measure must be taken to ensure freedom from adherence of the iris in cases where transparent corneal grafts are desired.

The technique of the operation described in previous papers, by the "cross-stitching" method is such that the gap in the cornea of the host is filled up accurately by the graft, which is held securely in place. A water-tight union is obtained, and re-establishment of the anterior chamber is ensured. These results depend in large measure upon the sloping or shelving edge of the graft, and of the hole in the cornea, and upon the adequate and uniform pressure on the graft to hold it securely in place.

Re-establishment of the anterior chamber as soon as possible after the operation is necessary to allow the iris freedom from adhesion to the graft. The central position of the graft over the middle of the pupil, and the optimum size of the graft, are factors which allow the iris to remain free when the pupil dilates.

Notwithstanding these precautions, it was found on experiment that the iris not infrequently became adherent, and it became evident that further investigation was necessary to obtain better results.

It had been noted from the earliest experiments that after opening the anterior chamber, a fibrinous clot was formed in the conjunctival sac, and fibrinous material rapidly formed on the stitches. The stitches would sometimes be bound together so firmly that it was a very difficult matter to separate them without doing any harm to the graft. Lumps of fibrin would form on the stitches, so making it difficult to manipulate them, and to tie the necessary knots. The aqueous of the rabbit contains fibrinogen, and the troublesome clot was fibrin. The first attempt to overcome this difficulty was to mop up the aqueous as soon as the anterior chamber was opened. This resulted in some improvement, but fibrin was still formed.

Prevention of formation of fibrin was then attempted by using 1 per cent. sodium citrate solution to wash away the aqueous after opening the anterior chamber. The result of this was to eliminate the difficulties of fibrin formation during the operation, but in two experiments the iris was in each case adherent to the graft.

It is now realized that the fibrinous clot which formed lumps on the stitches and caused them to stick together so firmly would form a basis by which the iris would adhere to the graft, and

that this attempt to reduce the technical difficulties of the operation was leading towards a solution of an important problem in experimental corneal grafting, the problem of keeping the iris free. It was now appreciated that the adherent iris in the last two experiments was probably due to the fact that the graft itself had not been washed with citrate solution, so that thrombin would form on the graft, which would act on the fibrinogen in the aqueous, even in the presence of citrate, when the graft was applied to the eye. Thus a fibrinous clot would form—facilitating adhesion of the iris to the graft. Realising the tendency of the pupil to contract, even after the use of atropine, when the anterior chamber was opened, the problem presented itself of keeping the pupil dilated under these conditions.

In the next experiment the graft was bathed with citrate solution as soon as it was cut, and the eye of the host was treated similarly. In addition to these precautions, an attempt was made to limit the dilatation of the blood vessels in the iris, as well as to limit the formation of fibrinogen, by the use of adrenalin drops after opening the anterior chamber. The result was that the pupil was dilated and free from the graft *at the end of the operation* in a manner that had not been obtained in previous operations. The experiment was repeated, with the same result. In each case the iris remained free.

One of these grafts was homogeneous, and in this case the graft became transparent. A few haemorrhages were present on the iris a few days after the operation. The other graft was heterogeneous, and it was the only one of the five heterogeneous grafts in which the iris remained free, the other four having been transplanted before these improvements were introduced.

The presence of small haemorrhages on the iris in the last experiment, possibly influenced by the use of 1 per cent. sodium citrate, indicated the desirability of reducing the amount of citrate, and balancing the solution with a percentage of sodium chloride. Matthews' Biological Chemistry contains a statement that 0·125 per cent. to 0·25 per cent. sodium citrate is sufficient to prevent blood from clotting. In the next experiment the solution used was 80 c.c. normal saline (0·9 per cent.) with 20 c.c. of 1·25 per cent. sodium citrate corresponding to 0·25 per cent. (0·9 per cent. of sodium citrate solution. The pupil in this case was free and dilated at the end of the operation and the iris remained free. There was, however, just a little fibrin formation during the operation, and rather a lot of the citrate solution had to be used to prevent its formation. It seemed that there was only a small margin, with hardly any allowance for dilution by the aqueous, and that with hardly any allowance for dilution by the aqueous, and that for the next experiment a slightly stronger citrate solution should be used.

The relative tolerance to atropine in rabbits is acknowledged, and a trial was made of various mydriatics in order to choose the most suitable for the purpose. According to Dixon laevo-hyoscyamine is 12 times more powerful than dextro-hyoscyamine, and twice as powerful as atropine in its action on the eye. A comparison between laevo-hyoscyamine and hyoscine showed that the former has a stronger and more prolonged effect on the pupil in rabbits. The mydriatic used for the experiments is in oily "solution." It was found that 2 per cent. laevo-hyoscyamine in olive oil caused the oil to become very viscid and jelly-like when cold, but that 1 per cent. did not do so. Consequently 1 per cent. laevo-hyoscyamine was chosen for use in the experiments.

In the next experiment these improvements were introduced. The citrate solution consisted of 80 c.c. of 0·9 per cent. sodium chloride, with 20 c.c. of 2·5 per cent. sodium citrate, corresponding to 0·5 per cent. sodium citrate. The result was very encouraging inasmuch as the pupil was dilated and free at the end of the operation, and was not even adherent to a stitch which had by accident penetrated the anterior chamber, and a portion of which lay deep to Descemet's membrane. The importance of using a solution that would be isotonic necessitated some investigation as to the tonicity of citrate solutions. The citrate molecule can dissociate into a number of ions according to the strength and pH of the solution. A theoretical estimate coupled with tests for isotonicity on rabbit's red blood-cells seemed to indicate that the best results would be obtained by a 3 per cent. solution.

For the remaining experiments entire satisfaction was obtained by using a solution consisting of 70 c.c. of 0·9 per cent. sodium chloride, and 30 c.c. of 3 per cent. sodium citrate. This resulted in 0·9 per cent. sodium citrate in the solution, which was sufficient to ensure freedom from fibrin, while the osmotic value was as near being correct as possible, and the percentage of sodium chloride in the solution would give an isotonic balance that would be reliable. One small detail has yet to be mentioned. It was noted that with all these precautions, a trace of fibrin was formed on the stitches, hardly enough to cause any difficulty, but it is much better to have the stitches supple and free, than for them to be in the slightest degree hardened and stiff by the formation of fibrin. The reason for the formation of this trace of fibrin on the stitches was that they had passed through corneal tissue, and the defect was remedied in the experiments that followed by dipping the sutures before use into the citrated saline solution.

If no steps are taken to prevent the formation of fibrin, or if the measures are inadequate, a fibrinous clot is apt to be formed on the deep surface of the graft. This often leads to impairment of clarity of the graft, and can do so in three ways: 1. By

establishing adhesion of the iris. 2. By forming a pabulum for the growth of connective tissue from the cut surface of the cornea, behind the graft, which, even when the iris remains free, causes an opacity to develop, deep to the graft's Descemet's membrane. 3. By organization and contraction of the fibrinous clot, wrinkling and folding of Descemet's membrane take place, appreciated clinically as grey lines in the deep layers of the graft, and confirmed histologically.

Thus, limitation of fibrin formation, and freedom from iris adhesion in operations for corneal transplantation, are of paramount importance, and can be ensured by the following procedure:

1. Establishing close apposition of the graft to its bed by the technique previously described as giving the best results. In this way a water-tight union can be obtained.

2. The use of a suitable mydriatic before the operation, and in the after treatment of the case.

3. Limitation of engorgement of the iris by adrenalin after opening the anterior chamber.

4. The use of citrated saline (70 c.c. of 0·9 per cent. sodium chloride and 30 c.c. of 3 per cent. sodium citrate) for application to the graft while it is being cut, to the eye of the host while the portion is being removed, and to the sutures before insertion.

With these precautions, in experimental rabbits, the iris remains free, and the pupil is dilated and free at the end of the operation.

Concerning Needles

In the operation for corneal transplantation, the needle has to pass for a distance of a few millimetres in the stroma of the cornea, and various needles were tried in order to select the most suitable. Although grafts of different sizes have been tried experimentally, it is found that the best results are obtained when the size of the hole in the cornea of the host is just over 4·5 mms. The needle most suitable for this size is, however, not so suitable when a larger graft is used.

For the standard operation it was found that a No. 3 needle (not eyeless) was too large, and there was a tendency for the superficial layers of the cornea to be torn at the point of exit of the needle when drawing the needle through. A No. 4 needle, which is about 5·5 mms. shorter than a No. 3, was found to be quite suitable, and gave every satisfaction. The needle used is of the half curved type. A straight needle was tried, but proved much more difficult to insert properly. Eyeless needles were also used. The length of a No. 4 eyeless needle corresponds nearly to that of a No. 3 needle with an eye, and this proved to be too long.

The needle corresponding in length to a No. 4 with an eye, is a No. 6 eyeless. It will be found, however, that the steel of an eyeless needle is more pliable than that used in the other variety of needle, and this is a disadvantage when the needle has to be passed accurately for some 4 mms. in the substance of the corneal stroma. Undue pliability is likely to lead to lack of control over the point of the needle, with the result that it may penetrate the anterior chamber, or cut its way out to the surface too soon. It is, however, an advantage that the eyeless needle can be drawn through so easily and smoothly without the added bulk of an eye with a double thickness of thread. The disadvantages of a No. 6 eyeless have been overcome by using an eyeless needle specially made, of harder steel, and similar in curve to a No. 4 half curved needle (with eye), but slightly shorter. In the application of corneal transplantation to man, it has been found that a needle of this type and length gives satisfactory results.

Concerning the threading of small eyeless needles with fine silk.—For threading these needles with No. 0 silk, a special pressure forceps is necessary, but many needles are liable to be spoilt by attempts at threading, as the procedure for fine silk is not as simple as it is for fine catgut. After trial of many methods, it was found that: 1. The pressure by the forceps frequently cut the thread, or 2. The thread slipped out of place when the pressure was applied. The forceps provided has a pressure surface of about 7 mms. with a small groove in which the end of the needle is placed. It was found necessary to cut the pressure surface down to not more than 3 mms., so that the blunt end of the needle could be left protruding about 0·5 mm., thus avoiding cutting the end of the thread where it leaves the end of the needle. Difficulty was experienced in keeping the thread in its proper place in the end of the needle, and this was largely due to the fact that the silk is so fine that it could slip about in the groove freely. Doubling and twisting the silk or moistening with water or a gummy substance to increase its thickness did not prove satisfactory, but the following procedure was found to give entire satisfaction if carried out carefully.

A single knot is tied in the silk, and the thread held taut is introduced into the groove in the needle; the thread is now drawn along the groove so that the knot enters the end of the needle and is drawn up to the other end of the groove. Still keeping the thread taut—a touch on the groove with a pin or the back of a knife will ensure that the thread and knot are in position. The forceps is then applied, leaving the last half millimetre of the needle projecting. The pressure effectively closes the needle end over the thread and knot, so that the suture is firm and secure.

The Sensitiveness of Corneal Grafts

Observations on the return of sensitiveness in corneal grafts were carried out over a number of years, and it was found that some of the grafts regained sensitiveness, while some did not. A record of these observations has already been published (*Proc. Roy. Soc. B.*, Vol. CVIII, 1931). The observations were based on 29 grafts, of which 21 became sensitive to light touch, and eight remained insensitive. Precautions were taken to ensure the accuracy of the observations.

23 *grafts were central* in position in the cornea. Of these, 16 became sensitive. There was no uniformity in these 16 grafts in regard to adhesion of the iris to the graft, good primary union, or ultimate opacity. Most of them were opaque, one nebulous, and two had clear areas. None was clear.

The common factor in all was that each had become vascularized. In some the blood vessels came from an adherent iris, in some from the periphery of the cornea, in some from both sources.

The seven insensitive grafts were free from adhesion of the iris, but in four of them there had been a minute adhesion of the iris for a short period. All seven had united well, and five were clear. One was opaque, and in it were some blood vessels.

Six grafts were situated near the periphery of the cornea.—Five became sensitive, and each had an adherent iris, was opaque and vascularized.

The insensitive graft also had an adherent iris, and was opaque.

In the whole series it was found that all the sensitive grafts were vascularized, while all the clear grafts were either completely or almost completely avascular, and remained insensitive. In one case a graft had a blood supply from an adherent iris for two months, but then the iris became free, so that the blood supply ceased; this graft became sensitive.

The conclusion was drawn that the establishment of an afferent nerve supply to a corneal graft depends upon a precedent or concurrent growth of blood vessels in that graft. It seems to matter little whether the blood vessels are supplied from an adherent iris or whether they grow in from the margin of the cornea.

Concerning Examination of the Pupil, Iris and Anterior Chamber in Cases where the Cornea is Opaque

During the course of the experiments it became necessary to find some means of ascertaining the presence or absence of adhesion of the iris in an eye with a dense and extensive corneal opacity. For this purpose a double transilluminator was made, controlled by a switch so that either light could be used separately, or both together. This has since been found a very useful method when

applied to man, in cases of dense corneal opacity, where the usual methods of examination leave one in doubt as to the state of the iris and anterior chamber. The transilluminators are applied on opposite sides of the eye. The room is darkened, and transillumination of the eye is carried out from either source of light, or from both together, without removing the lamps from their position on the eye. During transillumination of an eye with a clear cornea, such as an eye with a sarcoma of the choroid, one holds the light on one side of the eye, and observes the reflex from the other side, so that one has to move one's head from point to point—according to the place of application of the transilluminator.

In dealing with a dense corneal opacity, the conditions are different, inasmuch as the cornea acts as a screen on which the

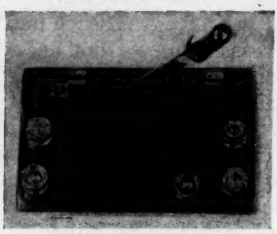


FIG. 12.

Switch used for double transillumination.

light impinges, proceeding from the interior of the eye through the pupil on to the cornea. The illuminated area of cornea can be seen without having to move the position of observation, no matter what part of the eye be transilluminated. Thus one can compare the illuminated area of cornea by transillumination of opposite parts of the eye. These areas can be contrasted in succession, or simultaneously by use of the switch (Fig. 12). In this way a good impression can be gained of the relative and actual size of the two illuminated areas, and of their positions on the cornea.

By this method of examination definite information can be obtained as to the size and form of the pupil, the depth of the anterior chamber, and the presence of anterior synechiae at the pupillary margin of the iris. The effect of mydriatics on the pupil can be determined. All these observations are difficult, if not impossible, by other means in cases where the cornea is completely and densely opaque; it is in such cases that this knowledge of the condition of the anterior segment of the eye is of great assistance when the operation for corneal transplantation is contemplated. By the method of double transillumination the following observations can be made:—

1. *The depth of the anterior chamber* can be judged by the distance apart of the two illuminated spots on the cornea. With a very shallow anterior chamber the two spots are practically superimposed (Fig. 13[1]). With a normal anterior chamber they are separated (Fig. 13[2]).

2. *The pupil.*—If the anterior chamber is shallow, the spot of light gives an approximate idea of the size of the pupil. The deeper the anterior chamber, the less clearly defined are the margins of the lighted areas. With a normal anterior chamber, if the pupil

DOUBLE TRANSILLUMINATION

FOR OPAQUE CORNEA

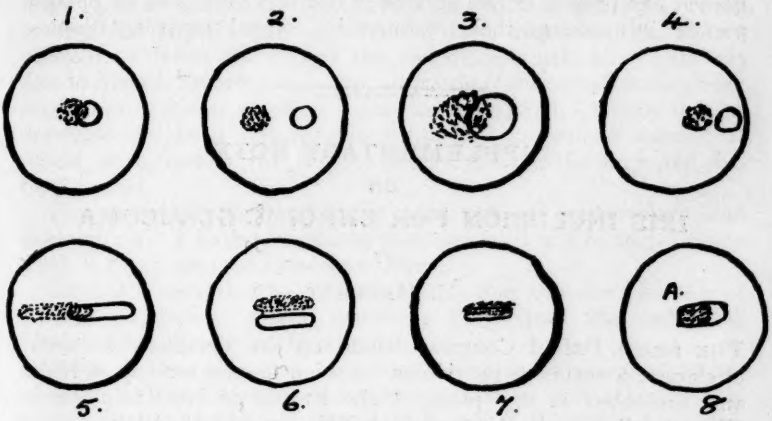


FIG 13.

1 = SHALLOW ANTERIOR CHAMBER. SMALL PUPIL.
2 = NORMAL ANTERIOR CHAMBER. SMALL PUPIL.
3 = NORMAL ANTERIOR CHAMBER. LARGE PUPIL.
4 = NORMAL ANTERIOR CHAMBER. ECCENTRIC PUPIL.
5 = NORMAL ANTERIOR CHAMBER. SLIT-LIKE PUPIL. Transilluminated at 180°
6 = NORMAL ANTERIOR CHAMBER. SLIT-LIKE PUPIL. Transilluminated at 90°
7 = SHALLOW ANTERIOR CHAMBER. SLIT-LIKE PUPIL. Transilluminated at 90°
8 = ANTERIOR SYNECHIA at "A."

is small, the spots of light are small and separated entirely from each other (Fig. 13[2]), while with a large pupil, the lighted areas are large and overlap (Fig. 13[3]). If the pupil is eccentrically placed, the arrangement of the illuminated areas on the cornea gives the clue to its position (Fig. 13[4]). With a normal anterior chamber, an elongated slit-like pupil (with the slit at 180°) gives overlapping slit-like lighted areas if transilluminated at 180° (Fig. 13[5]), but they are separated if transilluminated at 90° (Fig. 13[6]). With a shallow anterior chamber the two lighted

areas are almost superimposed, and their shape gives a clue to the shape of the pupil (or coloboma) (Fig. 13[7]).

3. *Anterior synechiae.*—An adhesion of one margin of the pupil to the cornea will give two patches of light on the cornea, having one common border, corresponding to the synechia, whereas the free margin of the pupil allows a separation between the other margins of the illuminated patches (Fig. 13[8]).

4. Alteration in the size of the pupil by mydriatics or miotics can be observed and recorded, and the presence of holes in the iris, or an atrophic thin iris frequently can be determined.

The examples given will serve to show the usefulness of this method of examination in cases of this type, and the information gained has proved of real service in dealing with cases of opaque corneae in man, and their treatment by corneal transplantation.

SUPPLEMENTARY NOTE ON IRIS INCLUSION FOR CHRONIC GLAUCOMA

BY

H. HERBERT

THE recent Oxford Congress debate on the operative treatment of glaucoma seems to provide an occasion for the remedy of faults and omissions in my paper "The Future of Iris Inclusion in Glaucoma," *Brit. Jl. Ophthal.*, Vol. XIV, pp. 433-48, 1930.

I.—The later phases in Operative Development

In the above paper the thesis was developed that progress in iridencleisis had for more than a decade resolved itself into a practical study of conjunctival fibrosis, protective against late infection. Work begun in India during the War, and continued fairly steadily up to the date of the paper, was reviewed.

There were three phases in this experience. The first was that of the uncut iris prolapse, condemned chiefly on account of a remote liability to the formation of a most dangerous leaking point in an over-stretched prolapse undergoing fibrosis.

Throughout the long second period the essential feature was free subconjunctival radial division of the iris with straight, narrow, blunt-pointed scissors, close to the forceps gripping the iris. By this means, together with such mydriasis as was obtainable by the omission of miotics from the previous afternoon or evening, and by

the free use of cocaine with adrenalin and atropine discs before operation, a degree of uniformity in results was obtained. Permanent relief of tension was assured, together with the desired restriction in the size and elevation of the prolapse, and a variable degree of fibrosis.

The final period was a very short one, and on that account, perhaps, to be reckoned one of great promise rather than of assured fulfilment. There was a very definite increase in fibrosis secured without any restriction of the required subconjunctival filtration.

This more assured fibrosis was obtained simply by the addition of a measured iridodialysis to the operative technique. The iris, seized near its base, was detached to the extent of 3-4 mm. by a steady pull of the iris forceps towards the centre of the pupil. Since writing the paper above mentioned I have regretted that in it I omitted to define the size of the iridodialysis utilized. This was due to limited experience. But obviously a very small detachment might have little or no effect. On the other hand, I believe that an unnecessarily large detachment could do no serious harm. It would bring merely the defects of any abnormally large and distorted pupil.

The experience still calls for wide general confirmation and exploitation. I have little doubt that this need will be met. Some work is being done on these lines now.

Clinical observation has shown clearly that the new tissue is of purely conjunctival origin, extending down into the underlying displaced iris, largely replacing it.

There is the wide area of dilated tortuous conjunctival blood-vessels. At first it seemed reasonable to attribute both the abnormal vascularity and the new fibrous tissue largely to friction and pressure of the upper lid upon the tissues, elevated by leaking aqueous. It is now clear, however, that the essential proliferative stimulus comes from mildly irritative products of breaking-down displaced iris tissue —products imprisoned for a time beneath the conjunctiva.

This is shown by the absolute localization of the new tissue to the site of the prolapse, by its very definite incorporation with the prolapse, and by the increased certainty and degree of the formative response that has resulted, in the final developmental phase, obviously from the enhanced rapidity and completeness of the degenerative changes in the *detached* and displaced iris.

It is shown also by the very rapid shrinkage of the abnormal conjunctival blood-vessels as the small patch of new fibrous tissue becomes visible.

The key to the degenerative changes in the iris prolapse has been found in clinical observation of the changes that have taken place within the eye in rare instances of old unintended operative iridodialysis.

A separated strip of iris may have been left at some operation almost in its normal position, normally attached only at one end, the other (displaced) end lying perhaps impacted in a sclero-corneal scar-line. The detached strip of iris is eventually reduced to a rather narrow grey band. The changes comprise shrinkage, loss of pigment and more or less loss of elasticity and contractility. In spite of the loss of colour there is no suggestion whatever of any new (fibrous) tissue in the shrunken iris.

The breaking down of spongy iris tissue has been accomplished quietly, and the products carried away suspended in the aqueous.

Some degree of these degenerative changes of detached iris must take place in any portion of iris permanently displaced under the conjunctiva. This was shown in early days after iris-inclusion operations of various kinds on the deeply pigmented Indian eyes, by a moderate permanent accumulation of black pigment granules beneath the conjunctiva immediately surrounding the prolapse.

And it is inevitable that in the final (third) operative period of prolapse with detachment of the iris-base, the breaking down of iris cells must have been more complete and more certain. The practical ultimate result must have been that there was little or no essentially uveal tissue left in the subconjunctival nodule, beyond the attenuated lining of pigment epithelium. (See photo-micrographs by Verhoeff and by Holth referred to in my previous paper.) That is to say, beyond the epithelial lining practically the only true uveal tissues remaining must have lain exclusively within the globe.

Contact of the covering conjunctiva with the degenerating iris nodule is essential if new tissue is to be formed. This was shown in early days by the complete absence of fibrosis in cases where a small prolapse lay buried beneath oedematous conjunctiva.

Contact alone, without any lid pressure, may be fully effective. This has been shown where, after previous operation of some kind, the conjunctiva has been so tied down locally to the sclera, that the small iris-nodule formed in the glaucoma treatment has produced a sharply defined elevation, distinctly above the level of the surrounding conjunctiva.

The sides of the small iris loop may then have a conjunctival covering as closely applied as that over the summit. The result is that at the sides, where there is no pressure and no friction of the lid, the fibrosis is as well developed as on top of the elevation.

One might fear that in such cases subconjunctival filtration might be insufficient for the relief of the glaucoma. But this has not been the case, apparently because there must always be a gap between a conjunctival product and the underlying sclerotic.

The fibrosis being essentially superficial in origin—conjunctival, and essentially of temporary growth—ending with the degenerative

changes in the displaced iris tissue, it can never be so excessive as to obstruct subconjunctival drainage.

According to present prospects, in this form of treatment there can be neither late infection nor late return of tension, and the filtration is never markedly excessive. In dealing with the spongy iris tissue there seems to be more natural adaptation throughout to the needs of individual cases, than with iris-free drainage.

The important question arises: Is the early increased fibrosis secured by the addition of iridodialysis to the operative technique likely to be always a permanent acquisition? There is some reason to hope so.

I have quite recently come across a patient upon whose eyes I operated by iridencleisis eleven years ago. In one eye there was unintentional iridodialysis; the detachment is unpleasantly obvious now through the cornea. In this eye there is no uveal pigment visible anywhere under the conjunctiva, and the site of the original prolapse is indicated by an ill-defined area of subconjunctival fibrous tissue. The whole filtration effect must be classed as satisfactory.

To contrast with the above, the result in the fellow eye, in which there was no iris detachment, is strongly objectionable. According to the new idea, the blood supply of displaced subconjunctival iris was not sufficiently interfered with. The early degenerative changes in the iris loop were not sufficiently massive, immediate and concentrated, to stimulate the full available proliferative response from the covering conjunctiva. About a year after the operation a note was made, "complete fibrosis of part of prolapsed iris. Dark patches showing incomplete fibrosis."

Since then there has been some slow absorption of the unfibrosed, abnormally placed, iris tissue. Now, situated about the middle of the widespread conjunctival oedema there is a small defined absolutely black patch, bulging slightly — evidently pigment epithelium, covered by thin transparent conjunctival epithelium.

If such a result were not surely preventable no one could recommend or practise iridencleisis.

II.—Early Sympathetic Ophthalmitis

The fear of sympathetic disease is still, I suppose, the great deterrent in the question of treatment by iris-inclusion. It remains only to exclude the possibility of the seeds of the disease being sown during operation or in the first few days afterwards. On this account it is worth while to recall my only post-operative case of sympathetic ophthalmitis in this country. The case was recorded in the 1930 paper, but it could not be dealt with satisfactorily in a paper that was otherwise becoming too long for sustained interest.

It was most fortunate from the point of view of iris-inclusion

treatment that there was no trace of iris impaction in the case, which was one of ordinary combined cataract extraction. The only early trouble was that, owing to a combination of unusual circumstances, the usual 2 minutes' perchoride of mercury irrigation (1 in 3000) of the conjunctiva, before the cocaine instillations, had been forgotten. And the omission was not detected till the instillations had all been made. It was impossible then to secure the usual effect of the pre-cocaine irrigation — some shedding of epithelial cells, embedded in mucus, to be washed away in sterile water.

It seemed desirable also to insure doubly against remote dangers, because it had been arranged that I was to see the patient once only in the after-treatment, namely, on the following day. For these two reasons I irrigated for three minutes exactly, instead of the usual two minutes, though the conjunctiva was perfectly healthy, pale and smooth. This period was slightly longer than I have used in any other case continuously, though in the case of slightly unhealthy-looking conjunctivae the routine two-minutes' pre-cocaine irrigation was often extended a little, and (or) supplemented by a short additional application immediately before operation.

This exceptional treatment proved to be a great mistake. It seems reasonably certain that the operation would have been perfectly successful, if there had been no conjunctival treatment at all.

On the next day the upper lid was found to be glued down so firmly to the cornea that it resisted mild attempts to separate it. Other similar adhesions that I have seen have given way easily to a little manipulation, and no harm has ever resulted. As there was no cocaine at hand I left the lid adherent. This also turned out to be a mistake. I ought to have persisted in freeing the lid. Though on the following day, I understand, the lid had separated naturally, the pull of the adhesion had been sufficient to produce a permanent gaping of the sclero-corneal section.

A variable slight separation of the deep wound margins is quite usual when a complete conjunctival flap has been utilized. Possibly this may be more certain where, as in this case, there has been a little preliminary sliding of the conjunctiva on the point of the knife in making the incision. But in this case the separation was quite exceptional, producing an obvious astigmatic distortion of the neighbouring cornea, sufficient to prove clearly that the gaping was, in part, due to the pull of the adherent upper lid on the cornea.

A flaccid lid, of course, could exert no pull on an eye at rest in its normal position. The drag could be exerted only when the orbicularis muscle contracted, or when the eyeball moved. That is, the traction must have been intermittent and active, spasmodic, producing some degree of suction at times. Any conjunctival contents lying close to the wound would be readily drawn into the

eye, especially considering that the conjunctival flap also was almost certainly adherent to the lid, so that the conjunctival wound would necessarily be pulled open.

Thus, to summarize: A suction mechanism was present for a period unique in my experience—more than twenty-four hours. A practically unique degree of corneal distortion sufficed to show that the mechanism had actually worked. As a not unnatural result of such working, indrawing conjunctival contents, we have the sympathetic disease, which was also unique to the degree above stated. That the association of such quite exceptional features was one of cause and effect is further borne out by the somewhat exceptional course of the disease.

Corresponding with the absence of any iris incarceration in the wound, the pupil and iridectomy-gap, though filled with organizing exudate, remained widely dilated to the end. They were fully dilated by the usual routine atropine instillations after the operation, and remained so under ordinary treatment.

There was no other possible suggestion in the case — nothing else in the least imperfect or unusual. The presumption of the working of a conjunctival micro-organism was very strong—I think, conclusive.

Though the case stands as an extreme warning against excessive, and more particularly against ill-timed, use of the antiseptic solution, it should not be allowed to detract at all from the undoubted value of its correct employment. This employment in India did serve almost completely to exclude both sympathetic and septic infections.

The question was dealt with in the 1930 paper. On present evidence practical temporary sterilization of the conjunctival surface, obtainable by several methods, affords ample security for any correctly planned iridencleisis operation. Consequently, in operating without one of these proved safeguards, one unnecessarily incurs a very grave responsibility.

To consider for a moment the active agent in the disease: It being practically certain in this case that the specific organism was drawn into the eye from the conjunctiva by the mechanism portrayed, valuable material for research was wasted. A somewhat exceptional opportunity was thrown away.

"There is no originality of thought in incriminating a virus without supporting evidence" (R. T. Brain, *Brit. Med. Jl.*, p. 194, July 29, 1933). But, the search for bacteria in this disease having failed, some organization appears to be needed for collecting a little of the very scanty available material, and arranging for its investigation at a laboratory, such as the Freedom Research Laboratory, London Hospital, where virus research work is being carried on.

In this case the conjunctival epithelium might have shown

inclusion bodies and virus particles. A virus might have been grown on epithelial scrapings, and possibly the strain maintained for exhaustive research. From what is known of viruses, is it not much more likely that this perfectly normal conjunctiva should have served as a carrier for a virus than for a pathogenic bacterium?

P.S.—Neither in the above, nor in the 1930 paper, have I emphasized sufficiently, as I ought to have done, my firm conviction that the new fibrotic development will prove to be a far-reaching discovery, bound to influence greatly the future treatment of chronic glaucoma.

2. The more recent history of an extraordinary case discussed on pp. 447-8 of the *Brit. Jl. of Ophthal.*, Vol. XIV, 1930, supplies a warning that durable conjunctival fibrosis may under exceptional conditions be unobtainable by iridencleisis in the case of an eye that has already been repeatedly operated upon by other methods unsuccessfully.

In this particular eye four small flap sclerectomies had failed to relieve the plus tension, though at the subsequent iridencleisis the old scleral incisions (still visible) were proved to have remained open. The only possible explanation of the invariable failure of the sclerectomies was an abnormal restriction of subconjunctival diffusion and absorption of leaking aqueous—a restriction due to post-operative fibrinous deposits. A reasonable explanation of the formation of these very exceptional deposits was given.

After the iridencleisis, by which the tension was finally relieved, there was most promising early fibrosis of the prolapsed nodule of iris. But now this new fibrous tissue has all disappeared, and in place of the elevated nodule there is a wider flat defined patch of sodden semi-vesicular conjunctiva—a condition with which we have been too familiar. The abnormally restricted subconjunctival diffusion of aqueous must be held directly responsible for the objectionable leaking patch of conjunctiva.

H. H.

THE RELATIONSHIP OF HISTAMINE AND THE INTRA-OCULAR PRESSURE

BY

B. W. RYCROFT

LONDON

IN the pathogenesis of acute glaucoma there are two factors, one of which is of pre-disposition, the other of immediate excitation. The pre-disposing factors have long been known and include variations in scleral distensibility, increasing lens volume, and changes at the angle of the anterior chamber, but the actual exciting causes, which precipitate an acute attack of glaucoma, are less understood and are intimately related to the nervous control of the ocular capillaries and the disturbance of intra-ocular osmotic equilibrium; for the dominant note of acute glaucoma is essentially one of vascular strangulation in which a sudden uveal engorgement is grafted on to an eye made previously susceptible to it by structural alterations.

The purpose of this paper is to investigate possible immediate causes of this vascular disturbance and to correlate laboratory findings with clinical cases.

Theme

Duke-Elder has drawn attention to the close parallelism which exists between the reactions of the iris and the skin to local injury. He identifies the triple response of Lewis in the case of the iris as follows:—(1) Local dilatation of minute vessels which is comparable to the red streak on the skin. (2) An increased impermeability of the capillary walls, comparable to the wheal. (3) Widespread dilatation of the arterioles, comparable to the flare. But in addition to visible effects the disturbance of capillary permeability causes a rise in intra-ocular pressure. The effect on the size and permeability of the minute vessels appears to be due to the local liberation of an "H substance" in the tissues (*vide infra*), whilst the flare is dependent on the continuity of a reflex arc of the axon type, since it does not occur after cocainization. In the normal eye, therefore, it is possible by local intrinsic mechanism to bring about a rise of pressure chiefly by reflex disturbance of osmotic equilibrium and vascular engorgement; if this should occur in an eye in which the compensatory mechanism of decompression was faulty then the pressure would rise still higher and a condition of acute glaucoma be brought about. The problems which seemed to require investigation were:—(1) The effect of histamine on the intra-ocular pressure of the normal eye. (2) The identification of histamine in the aqueous in cases of acute glaucoma.

Histamine

(A) *General properties.*—Investigations of histamine commenced by the formation of an active amine by decarboxylation from the amino-acid histidine and were essetially pharmacological; later, the relationship of wound-shock in men and peripheral vaso-dilatation in animals came to be studied, culminating in the discovery of the part which the substance plays in skin reactions. For clinical purposes it was essential to use a method of detection which was rapid, sensitive and applicable in the ward, as decomposition of histamine takes place relatively quickly. It was, therefore, decided to use the intra-cutaneous injection and the production of a subsequent flare as the test, after the method of Harris, for although the Knoop colour reaction and methods of biological assay as used by Burn and Dale are eminently satisfactory in laboratory practice, they do not lend themselves to clinical methods of investigation. The general effects of histamine are as follows:—

(1) *On the salivary glands.*—There is an increased production of saliva which is partly due to chorda stimulation and partly to the mechanical effect of smooth muscle contraction (MacKay, 1927).

(2) *On the stomach.*—Histamine acts as a stimulant to the acid producing cells but has less effect on the peptic and mucoid cells, the net result being a rise in the volume of the gastric juice (Dobson, 1925 and Babkin, 1930).

(3) *On the blood vessels.*—Intra-venous injection produces a profound lowering of the blood pressure in the anaesthetized cat (Dale and Laidlaw, 1910). This is due to a wide-spread peripheral vaso-dilatation.

(4) *On the skin.*—In the human skin the arterioles are widely dilated (Harmer and Harris, 1926); Carrier has described the intense capillary dilatation in the finger nail bed. Lewis has described the triple response, which has been mentioned previously, and suggests, in view of the prolonged effects resulting from injury to the skin, that these are produced by a substance not identically the same as histamine, since this is so readily diffusible, but to an unknown substance related to it which he has termed "H substance." Dale has suggested that histamine is liberated from the cells locally and is mainly responsible for the effects on the skin, but that it is modified to H substance by loose combination. Krogh believes that a vaso-toxic substance is liberated from the cells but that it is composed of several components; acetyl-cholin has been suggested by Dudley as being one of them.

(5) *Smooth muscles.*—All authorities agree that there is stimulation and contraction of smooth muscle, a fact which is of advantage for the method of assay by the guinea-pig uterus.

(B) *The eye.*—In 1910, Dale and Laidlaw reported no change in the size of the pupil after intra-venous injection of histamine. Hamburger later found that instillation into the conjunctival sac produced miosis. Studying the effects on different animals Matsuda has described varying effects on the pupil: in cats no effect was found on the pupil after subconjunctival injection. Colle and Duke-Elder have shown that the intra-venous injection of histamine produces a rise of intra-ocular pressure provided that the tone of the capillaries generally was well maintained. Friedenwald and Pierce, using various animals, described the effects of injection of histamine into the anterior chamber and vitreous with subsequent histological results. They found that when intra-ocular pressure was kept constant, injection of histamine into the anterior chamber produced a rise of intra-ocular pressure, followed by massive congestion and oedema of the eye; into the vitreous, a more prolonged rise was produced. Dubar and Labache emphasize the variability of the results and this appears to be a current note in the literature; Dale has stressed such variations as the genealogical tree is ascended. It follows, therefore, that strict adherence to animal experimental results cannot be maintained.

Experimental Evidence

For the purpose of these experiments the technique followed was mainly that of Duke-Elder in which intra-ocular readings are taken by an optical manometer co-incidentally with a record of the general blood pressure. A modification was introduced in order to maintain the intra-ocular pressure constant whilst histamine was injected; this was brought about by means of reciprocating syringes acting as a shunt. Cats were employed under chloroform-ether induction, followed by light intra-venous chloralose. Blood pressure record was taken from the left carotid. In some experiments where gross changes were expected a saline manometer was employed (Fig. 1).

(1) *Conjunctiva.*—On instilling two drops of 1/1,000,000 histamine solution into the conjunctival sac there was a latent period of about four minutes, followed by a period of capillary dilatation, lasting about 10 minutes, in which the whole of the conjunctiva became red and congested. No constant action on the pupil was observed. With stronger solutions miosis was produced and in some cases marked irregularity of the blood pressure which was brought about by absorption. This may have some bearing on the general effects which certain patients experience after the use of preparations of concentrated histamine for the production of miosis (Fig. 2).

(2) *Anterior chamber.*—Injection of saline into the anterior chamber with no reciprocating mechanism produced a rise of intra-ocular pressure, but if an equal volume of histamine and saline was injected a similar rise of intra-ocular pressure was

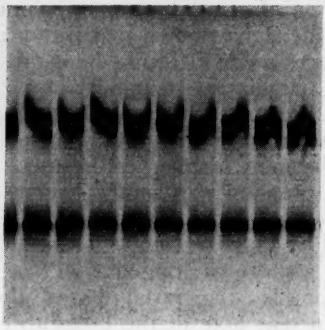


FIG. 1.

Normal tracing of intra-ocular pressure (cat), taken by optical manometer. The large waves are of respiration: the small waves are cardiac. Base-line photographed from fixed mirror. Time-marker: 5 sec. blank.

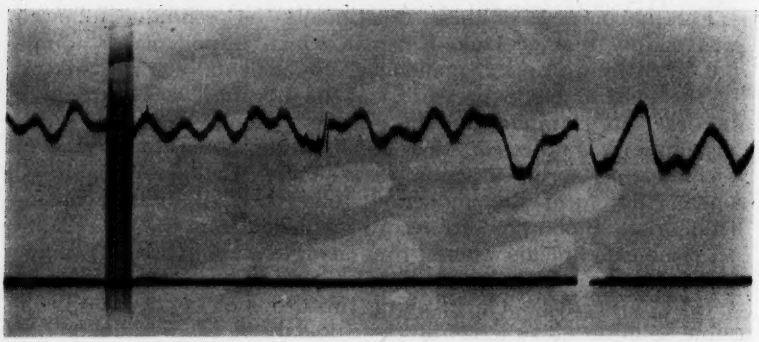


FIG. 2.

At signal, the conjunctival sacs of both eyes were flooded with 1:1000 solution histamine. Thereafter, there was marked irregularity of intra-ocular and blood pressures (cat).

produced, followed almost immediately by a further subsequent rise which was due to the effect of histamine. With the reciprocating mechanism in use injection of histamine alone produced a rise of intra-ocular pressure. The general blood pressure was found to vary and no constant fall produced (Fig. 3).

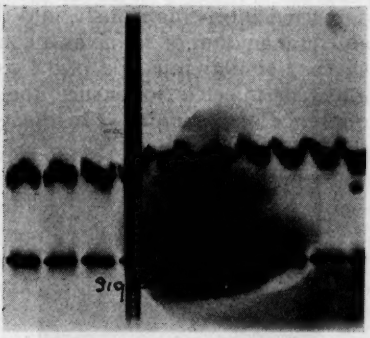


FIG. 3.

Fig. 3 shows rise of intra-ocular pressure following injection of histamine into aqueous. At signal, 0·3 of 1:10,000 histamine solution was injected into the anterior chamber of a cat, the intra-ocular pressure being kept constant during injection.

(3) *Vitreous.*—Injection of histamine into the vitreous was in all cases followed by a sharp and well-maintained rise of intra-ocular pressure, subsequently followed by a gradual fall.

(4) *Blood stream.*—Intra-venous injections confirmed the work of previous observers, namely that if the capillary tone generally is good the fall of general blood pressure produces a rise of intra-ocular pressure due to local capillary dilatation and increased permeability. In very prolonged deep anaesthesia the capillaries are partly atonic. These effects are not constant and the rise of intra-ocular pressure may be replaced by a fall (Fig. 4).

Clinical Evidence

In these experiments an endeavour was made to correlate the experimental results with clinical cases of acute glaucoma and to identify histamine or "H substance" in the aqueous of these cases. Four cases of primary acute glaucoma were selected all having tonometric tension of over 70 mm. of mercury, and uncomplicated by previous operation or miotic treatment. All cases of primary glaucoma do not lend themselves to these experiments since it must be possible to extract aqueous without risk of gross damage; this postulates an anterior chamber which is not too shallow and accordingly cases have to be selected. Two control cases of primary optic atrophy were employed. The technique of the experiments was to tap the anterior chamber obliquely with a fine bore hypodermic needle and to withdraw 0·2 c.c. of aqueous. Retrobulbar and sub-Tenon anaesthesia were employed and no

part of the conjunctiva was penetrated. The aqueous thus obtained was immediately injected intra-cutaneously into the flexor surface of the forearm; an equal amount of saline as a control was injected alongside. Next day, a similar injection of 0·2 c.c. of 1/1,000,000 histamine solution was injected to ensure that all cases were sensitive to the presence of histamine. In the two control cases

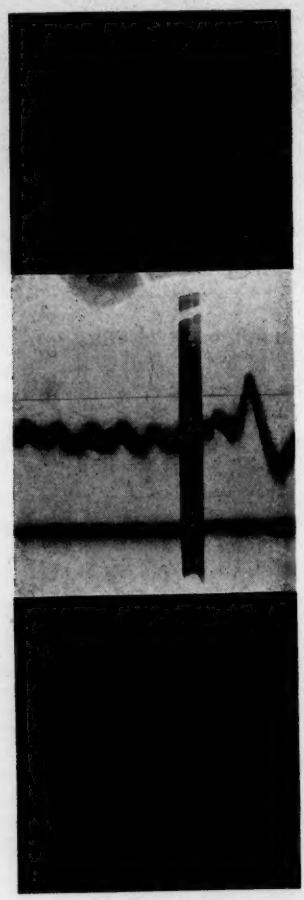


FIG. 4.

Fig. 4 shows synchronous fall of systemic blood-pressure and rise of intra-ocular pressure. At signal, 0·3 of 1:1,000,000 solution histamine was injected into the left femoral vein. Cat: ether and chloralose.

of optic atrophy no reaction was obtained by the injection of aqueous or saline; the histamine injection gave a flare in both cases. In three of the four cases of primary glaucoma a small but definite flare was produced. In one case no flare was obtained, and in none was there a wheal. Friedenwald has carried out similar experiments on the relationship of histamine to acute glaucoma and the intra-ocular pressure. He states that the injection of histamine into the vitreous produces histologically changes in the ciliary body and processes similar to those found in acute glaucoma in man. The lesion, however, is less severe than that in human beings. In no case was obstruction of the filtration angle produced. The author has had similar experiences and found that it is impossible to produce a permanent obstruction at the angle of the anterior chamber by these injections into animals, the reason being that the ciliary body is small and the anterior chamber usually deep. Friedenwald carried out further investigations by injecting glaucomatous aqueous into the skin in one case; in this case he obtained a wheal measuring 7·5 mm. 17 minutes after injection. This, however, was obtained from an eye in which an iridectomy had been performed nine days previously and, therefore, the presence of histamine from the operation cannot entirely be excluded. Control aqueous from the conjunctival sac during extraction of a senile cataract was used but this can hardly have been free from contamination. He concludes that a vaso-toxic substance is present in the aqueous in glaucoma which is capable of producing an urticarial wheal elsewhere in the same patient. The author has never been able to produce a wheal although using a larger quantity of aqueous than this observer.

Conclusions

(1) That the effect of histamine on animal eyes varies according to species.

(2) That the injection of histamine into the eye of a cat will produce *per se* a rise of intra-ocular pressure independent of that due to its own volume.

(3) That a vaso-toxic substance is present in the aqueous in cases of acute glaucoma but that at the moment its nature is indeterminate; it is possibly "H substance" or is related to it.

It is proposed to extend the clinical evidence further as no final conclusion can be based on three positive cases and to investigate the parallel effects of acetyl choline which may also play a part.

My thanks are due to Sir Stewart Duke-Elder for his constant interest and advice, to Professor Lovatt Evans for many courtesies

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RICHARD BANISTER

Additional facts in relation to the Father of British Ophthalmology

BY

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SLOANE MS. 3801 in the British Museum, published in full in "Studies in the History of Ophthalmology in England prior to 1800" is of importance because of the wealth of detail about itinerant oculists in the early part of the XVIIth century. It is an anonymous, undated tract which ends abruptly in the middle of autobiographical details concerning its writer. The Museum authorities dated it in the time of Charles the First, and Mr. Harvey Bloom judged its date to be between 1630 and 1640. The writer speaks of himself as an oculist and mentions his brothers Gabriel and John. He also states that he was trained by his uncle, the author of a "booke of Anathomy." Because of

the facts that Richard Banister had a " neare and deare kinsman," John Banister by name, the author of an anatomical text-book; and also mentions in his will four sons named Gabriel, Richard, John, and Francis; and in view of the fact that Richard Banister died in 1626, it was suggested in the " Studies " that the writer of MS. 3801 might have been one of his sons. Further search would seem to point to Richard Banister himself as the author of this MS. The following facts deserve attention.

(1) " Ye chefeste oculistes that have bene in this lane or is at this day " as given in the MS. are Luke of Erithe, Mr. Surphlete, Master Barnaby of Peterborough, Earle in Staffordshire, Henry Blackburne and his pupils, Nelson, Page and Hanle.

Personal acquaintance with most of these is indicated in Richard Banister's *Breviary;* the author relates that he laboured to advance his skill " by the advice of the most skilful in those times; as namely Henry Blackburne, . . . Robert Hall, of Worcester, Master Velder of Fennie-Stanton, Master Surflet of Lynne, and Master Barnabie of Peter-Borough."

(2) The writer of the MS. relates that he trained under his uncle " 5 or 6 yeares in ye practice of surgerye atte ye time I was with him I ever collected what receiptes I could and carefully observed alle practise. . . . At Sleaforde where I lived welle for fourteen yeares and carefullye and studyed much my Uncle's booke of Anathomy . . . and I had divers good books of surgerye which I dayly (had) recourse to as occasion was offered in practise . . . I made all my medicines myselfe. . ."

In Richard Banister's *Breviary* the author explains that his " speciall breeding had bene in the general skill of chirurgerie ... at the feet of a Gamaliel . . . by name John Banister, my neere and deare kinsman . . . (the author of) a booke of anatomie . . . labouring to bee as cunning in knowledge of the reason, as perfect in practice . . . I addressed myself to the study of divers best approved authors, as Resis, Mesue, Fernelius, Vesalius, and others." Discussing the " three companions " of " every perfect cure," he states " for the medicines I dayly used, I made them my selfe."

There is much similarity in the extracts given from these two sources. The " booke of Anathomy " is an obvious connecting link. It is very much against the view that the author of the MS. was one of Richard Banister's sons, that the writer makes no mention of his own father. Nor is the suggestion that Richard Banister himself was the author of both documents weakened by the supposition that two of his brothers had the same names as two of his sons. The difficulty of dating the MS. to the time of Richard Banister is overcome if it be antedated by about 15 years.

This negative evidence apart, there is one fact which is practically conclusive. The author of the MS. states that he lived in Sleaford; at first sight this might seem to point away from Richard Banister, who dated his *Breviary* from Stamford. But the following extract from Flint South's "Craft of Surgery," edited by Sir D'Arcy Power (London, 1886), p. 152, fully establishes the claim of Richard Banister to a surgical training and confirms the supposition (made in the Short History of Ophthalmology) that the writer who practised for 14 years in Sleaford was none other than Richard Banister, the father of British ophthalmology:

"July 8, 1602. This daye Richard Banister of Slyford in the County of Lyncolne Surgeon was examined and approved before the Masters of this Company by Mr. Wood, Mr. Baker, Mr. Thorney and Mr. Willm. Martin concerninge his skill in the practize of surgery. And he was found an hable (*i.e.*, skilful) and fitt man to use the same."

The evidence available, therefore, points to the author of Sloane MS. 3801 as being a surgeon from Sleaford, who studied under his uncle, and later became an oculist, and wrote and thought very much like Richard Banister, of whom we know that he was a relative and pupil of the celebrated John Banister, the author of an anatomical textbook.

Stamford is only about 25 miles from Sleaford, but being on the North Road would, in Banister's day, have been a more convenient centre for his work as an oculist than a place like Sleaford.

We therefore consider it justifiable to ascribe this interesting MS. document to Richard Banister, who thus puts English ophthalmology still more in his debt.

The following additional facts relative to the Banister family may be inserted here.

In the will of John Markham, gent., dated 26 July, 1607, is the following bequest.

"To Mr. Richard Banester in respect of his great paines taken within this my sickness, and of many other kindnesses by him done unto mee, 20 marks." (Maddison's *Lincoln Wills*, 2nd Series.) In this will the testator describes himself as "one of the sonnes of John Markham, late of Seidbroke in the County of Lincoln, Esq." We have been unable to locate Seidbroke on the modern map of Lincolnshire, but would hazard the suggestion that perhaps Sedgebrook, near Grantham, and about midway between Sleaford and Stamford, may be the place in question.

The fact that John Banister was the uncle of Richard enables us, through the kindness of Sir D'Arcy Power, to trace the family pedigree a little further back; though we do not yet know the name of Richard's father. But John Banister was second son

of John Banister of Cobham, Surrey, Baron of the Exchequer. John Banister, the anatomist, saw military service as surgeon to the forces sent to relieve Havre in 1563, under the command of the Earl of Warwick.

We regret that we are unable to give any further facts about Richard Banister's grandfather. We should have surmised that some details ought to have been forthcoming about a man in his position; but Mr. Harvey Bloom was unable to find his will at Somerset House; though he sent us notes of the wills of four Surrey Banisters of the XVIth century; of these that of John Banester, clerk, parson of Schire (Shere) dated 24 February, 1514, may be a reference to a collateral ancestor. He desired to be buried in the church of the Friars Preachers of Guildford. He mentions his nephew, Robert, and his children, Richard, John, Nicholas, William, Thomas, Oliver, Anne and Agnes. He left a silver cup to the Earl of Surrey and another to Sir John Legh of Stokewell, Knt. The will was proved 14 January, 1516-17 (P.C.C. 19, Holder). It will be noted that the name of his second son was John.

VOLUMINOUS ORBITO-CRANIAL OSTEOMA. CONSECUTIVE CEREBRAL ABSCESS, OF NASAL ORIGIN

BY

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IN 1930, I published the case report of a young girl, who had consulted me for a large osteoma of the orbit. This tumour I had removed by a supra-ciliary incision; and the eye conserved its entire physiological function. Besides this tumour, my patient presented, on the corresponding side, a peripheral facial paralysis, and by elimination of the possible causes, I have classified this affection, which has been cured within four months, as being *a frigore*. The ethmoid bone had been the point of origin of the neoplasm, and in spite of its radical removal, a relapse came on the same place, a few years later. The great interest of the present case report is that this time the osteoma, originating in the ossification of a fibroma, had at first invaded the orbit, afterwards extended to the cranial cavity, and spread infection to the brain. During operation I discovered a vast abscess of the frontal lobe. Considering these facts, and the medical literature perused, I believe I can say that this case report is the first one ever published on such a subject. This is the history of my patient,

who died of diffuse leptomeningitis twenty-eight hours after operation.

Case report.—Miss C.N., aged 24 years, was admitted to my service at Notre-Dame Hospital, on January 26, 1933, for troubles of the right oculo-frontal region. This patient, from whom I had already removed an osteoma of the orbit weighing twenty-eight grammes, on May 8, 1925, related that since the operation she enjoyed an excellent state of health until October, 1931. She noticed from this moment a sensation of fulness in the orbital cavity, without feeling any pain. The eye was projected forward very slowly, but the vision remained good, and she never complained of diplopia. Headaches localized to the right and starting from the frontal region, appeared in about one month.

On examination I observed a slight direct exophthalmos of the right eye, which nevertheless conserved all its mobility. The lids cover exactly the cornea, whose sensibility is perfect. The pupilla reacts well to light. There exists epiphora, but the lacrymal ducts are permeable. The papilla is normal, so are the membranes of the fundus of the eye. With the diploscope of Rémy, I noticed a good fusion of images. Nothing interesting was found in the left eye and vision of both eyes was 1/3. Though, after the correction of a mixed astigmatism it rose to 2/3.

O.D. $105° + 2{\cdot}25 - 0{\cdot}75 = 2/3$.
O.S. $120° + 2 \quad - 0{\cdot}50 = 2/3$.

The right orbital roof is painful on pressure, and with the little finger I felt a neoplasm on luxating the globe slightly downwards. The patient complains of headaches localized in the frontal region of the corresponding side.

On anterior rhinoscopy I found a right nasal fossa without pus, absolutely free, but presenting anosmia. There exists to the left a slight spur of the septum. On this side the sense of smell is normal.

The pharynx and the cavum offer nothing particular.

Diaphanoscopy allows us to see that all sinuses of the face are quite transparent.

In the presence of this exophthalmos in my patient, already operated on for an osteoma, I immediately thought of a relapse, and asked for a Roentgenogram. And this by Dr. Laquerrière gave me the following information.

"On the radiogram of the face: complete opacity of the right orbit; corresponding frontal sinus normal."

"On the radiogram of profile: nippled bony tumour, more voluminous than a large nut, localized forward in the posterior part of the orbit, and in rear in the cranial cavity." (See Fig. 1.)

The patient having a temperature of 102·4° F. was immediately ordered to bed, and I told her that before removing the tumour, it would be necessary first to enucleate the eye, and that operative

intervention might offer serious consequences. Impressed by these explanations, she asked to be allowed to consult her family. During the following days, the symptoms grew considerably worse. Indeed, headaches became more intense, temperature oscillated between 97° and 100° F., and she had vomiting. From time to time she suffered

FIG. 1.

Orbito-cranial osteoma.

want of sleep or torpor. By lumbar tapping we obtained a clear liquid which escaped from the canula without pressure. Analysis of this liquid gave the following report:—

Lymphocytosis normal.

Bacteriological examination negative.

Albumen 0 gr. 60.

Blood test gave a negative Wassermann reaction, and a normal quantity of urea.

Traces of albumen in urine, and absence of sugar.

During the second week after the admission of the patient to the hospital, nervous troubles increased, and headaches became more severe and persistent. She presented always a little hyper- or

hypothermy, accompanied by somnolence or want of sleep. Nevertheless, the discs were not choked, and vision was maintained. On February 9, I reiterated the advice to undertake an intervention which, this time, was accepted to take place on the following day.

Operation.—In the presence of the condition of apathy manifested by the patient, the anaesthetist administered rectally to her 6 c.c. of avertin, which produced an ideal sleep. After asepsis of the field of operation, I practised an external canthotomy, followed by an exenteration of the orbit. I then discovered a nippled osteoma filling all the superior half of this cavity. By its adhesions, it was easy to conclude that the neoplasm had its origin in the ethmoid bone. Using the gouge and mallet, I freed its nasal implantation. As the tumour was spongy at certain places, and as I did not wish to fracture the thin walls of the orbital cone, in trying to remove it altogether, I parcelled it with a cutting forceps. I mobilised with an extreme prudence its cranial part with a lever, once I arrived at the bottom of the cavity. During these manoeuvres, my surprise was great when I saw gradually flowing out from the frontal lobe about 20 c.c. of pus. Needless to say the last portion of the osteoma was removed trying as far as possible not to disseminate the infection. The intervention, which had presented no difficulty, was finished by a few points of suture to the external canthus, drainage of the abscess, and an aseptic dressing. Though the loss of blood was very small, I prescribed 500 c.c. of glucosed serum in intravenous injection and 2 c.c. of coramine intramuscularly, in order to attenuate a little the shock produced by the operation. The awakening was normal, and the following night sleep was calm. However, the next day, the patient complained of headaches, had incontinence of urine and vomiting. Fever reappeared and gradually increased. She became unconscious in spite of all the stimulants administered, and began then to be delirious. The breathing rose to 40, the pulse to 160, and she died twenty-eight hours after the operation with a temperature of 103·1° F.

The autopsy, performed by associate Prof. Simard, permitted us to make, among others, some very interesting observations of the orbito-cranial region.

"The cadaver is one of a young woman well constituted but emaciated."

"The right eye is absent as well as the orbital roof. The orbital cavity is filled by a clot of blood which is continuous with another clot adherent to the right frontal lobe of the brain. The right frontal sinus is intact."

"On the inferior side of this lobe, exists a loss of substance in the form of a cupola, of four and one half centimetres in the transverse diameter, of four centimetres in the antero-posterior direction,

and of a depth of two centimetres. This loss of substance is replaced by a red blackish mass, striated with grey bands, which is continuous with the clot of the orbit."

"The olfactory bulb and nerve of the same side are destroyed."

"The borders of this cupola, seen with the microscope, are constituted by parcelled cerebral tissue, strongly infiltrated with red corpuscles. The bottom is carpeted by a purulent layer."

FIG. 2.

Abscess of the right frontal lobe.

"There exists, moreover, a diffuse leptomeningitis." (See Fig. 2.)

The fragments of the tumour reunited weighed forty-three grams, and from the macroscopic point of view, it was nippled in the orbit, as well as in the cranial cavity, presenting at certain places spongy parts, or very hard ones.

Professor Pierre Masson, who made the anatomo-pathological examination of a piece of the neoplasm grown into the skull, gave me the following report.

"The tumour has an hemispheric form, and is amalgamated with the orbital roof. It is very hard, and must be divided into slices with a fine saw."

"It contains two regions of different structure. One external or cortical, formed by a very compact bony tissue having narrow Haversian canals and resembling that of the diaphysis of a long bone. The other, deep, is formed by a tissue of variable structure according to the points: this tissue is fibrous in places, very dense and having large capillary vessels running through it. Elsewhere osteoid galleries spring up in places. These osteoid galleries are continuous externally with the compact bone which forms the superficial shell of the tumour. Between these young galleries, there exists only fibrous tissue and vessels, no red marrow."

"The bony tissue seems to be altogether stable in the compact region. The Haversian canals are not bordered by osteoblasts in epithelioid arrangement order,—sign of bony increase—nor by myeloplax included in the lacunae of Howship,—sign of resorption. We find pictures of increase and resorption (these very rare) only in the deep region."

"This tumour is a pure osteoma springing from the direct and progressive ossification of an initial fibroma. In no place the tumour presented, either on its surface or in its interstices the least inflammatory lesion."

In appreciating the facts exposed in this case report, I shall avoid repeating as much as possible what I have already said in the publication of my first paper; though, I shall recall that my patient never had formerly any infections of the nose, that she never received any trauma on the naso-frontal region, and that her orbital osteoma had sprung from the ethmoid bone without any apparent cause. This tumour, particularly hard, had been totally removed in 1925. Desirous to know then its imperviousness to the X-rays, I had it radiographed with the head of a small statue in ivory, of a size relatively equal to the neoplasm, which had given the same opacity for the two objects (see my illustration).*

From the history of the patient, cure maintained itself during six years; though it would be logical to believe that a recurrence had begun before October, 1931, and that the first manifestations had passed unperceived. As we all know on the other hand that osteomas of the orbit have a rather slow evolution, the neoplasm of the patient would have attained with difficulty a volume of forty-three grams in the space of sixteen months.

The anatomo-pathological examination has furnished information of a special interest. Indeed, it has been demonstrated that the tumour, developed on the old cicatricial tissue of the ethmoid bone—observation made during operation—had at first been a fibroma which, in process of time, had progressively undergone ossification. Contrary to what I had found during the first operation, where the osteoma, very hard, had invaded the orbit in pushing the eye forward,

Annales d'oculistique, Paris, Vol. CLXVII, p. 830. October, 1930.

its recurrence offered a semi-spongy, semi-ivory-like consistency prolonging itself in depth in the cranial cavity, with only a slight exophthalmos.

Let us see now in what manner the brain has been infected. At diaphanoscopy, on Roentgenogram, and especially at autopsy, the frontal sinus corresponding to the tumour had been found absolutely normal. We must then admit that the infection had its point of origin in the nasal fossa, and that it slowly reached the meninges—by the posterior way of the neoplasm most probably. If the patient had never presented retro-bulbar abscess, it is because the infection, chronic at the first outset, with a very slow evolution, had never manifested itself under an acute or sub-acute form, consecutive to a severe rhinitis for example. Though the fragment of the intra-cranial tumour examined under the microscope has not shown any inflammatory signs, this fact does not invalidate the hypothesis that the microbes coming from the nose had proceeded to the brain by the cortical part of the osteoma. The cerebral pulsations, transmitted to the meninges in contact with the tumour had produced in time a wearing out of the dura-mater, by which infection then propagated itself to the frontal lobe. It would not be reasonable to suppose that the infection had followed the cribriform plate of the ethmoid bone to reach the brain, because the patient, since her first operation, never had ethmoiditis, at my examination the right nasal fossa was normal, and at the autopsy no pathological finding was observed in the region of the crista galli apophysis.

I regret not to be able to furnish a microscopic report of the pus evacuated from the abscess of the brain. The virulence of this pus was very strong, since twenty-eight hours after operation, the patient died with a temperature of 103·1° F. Moreover Associate Professor Simard, who has practised researches on cerebral sections limiting the abscess, found that this tissue was parcelled and strongly infiltrated with red corpuscles, that it was carpeted by a purulent layer, and finally that there existed a diffuse leptomeningitis.

At the time of the clinical examination, I observed that the right nasal fossa, although quite free, presented anosmia,—and that smell was normal on the left. This phenomenon is explained by the destruction of the olfactory bulb and bundles, consecutive to the abscess of the corresponding frontal lobe.

I shall underline the fact that in spite of the fairly considerable development of the cranial osteoma, the papillae, on ophthalmoscopic examination were not choked, and that on lumbar tapping, the liquid escaped without pressure. Moreover, vision of the right eye had always remained good, since the orbital neoplasm had invaded the superior part of this cavity only, without coming in contact with the optic nerve.

The clinical symptoms, and the Roentgenogram examination have not allowed me to make a diagnosis of an abscess of the frontal lobe, for the headaches at this region, could well have been due to the tumour, and the rise of temperature, as well as vomiting, to a reaction of the meninges. Though, if I had thought of such a complication—observed for the first time—it would have been instructive to see what a ventriculography would have given.

To sum up this case report, I shall say :—

1. That my patient, in 1925, had had radical operation for an osteoma of the orbit, developed on the ethmoid bone, having the consistency of ivory ;

2. That the cure was maintained apparently until 1931 ;

3. That from this epoch a recurrence manifested itself in the form of a fibroma starting from the nose ;

4. That this fibroma underwent ossification ;

5. That this tumour invaded at first the superior half of the orbit, and then the cranial cavity ;

6. That the nasal infection propagated itself by way of the tumour to the brain ;

7. That during the operation an abscess of the frontal lobe was discovered ;

8. And finally, that this patient died of diffuse leptomeningitis twenty-eight hours after intervention.

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BILATERAL PAPILLITIS FOLLOWING ANTIRABIC INOCULATION: RECOVERY*

BY

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ON April 6, 1932, a healthy looking Anglo-Indian lady, aged 31 years, came to see one of us (H.S.C.) with the following history:—

On about March 27, 1932, the sight of her right eye began to go dim and three days later her left eye began to go dim also.

When first seen, on April 6, her sight was: Right eye 6/36 and left eye = No perception of light.

Both pupils semidilated: Right pupil contracted to light but did not remain contracted. There was also a consensual contraction of left pupil and it also was not maintained.

The left pupil was quite inactive to direct light and there was no consensual reaction. The ophthalmoscope showed a typical papillitis of both discs. A swelling of between $1\frac{1}{2}$ to 2 dioptres in each. No haemorrhages or exudates. Apart from her very natural mental distress she was not ill.

She was admitted to the Rangoon General Hospital, and the first physician was asked to examine her with the object of finding a cause for the condition. His results were uniformly negative. Her other cranial nerves were normal. She was put on mercury, potassium iodide and strychnine injections.

Towards the end of the second week of her stay in hospital she said the sight of her left eye was coming back. One was doubtful of this till it was noticed that the pupil of that eye was beginning to react to direct light.

From this time onwards the improvement in her sight in each eye continued and she was discharged at the end of two months with full vision (6/5) and full fields in her right eye. Her left eye was the same except that she complained of a faint "shimmering haze" in front of this eye. This was due to a small centro-caecal scotoma which shows up on a Bjerrum's screen with a 2 mm. test object (white) at one metre. Her distant vision in this eye was 6/5 three letters and she read Jaeger No. 1 correctly but much more slowly than she did with her right eye.

Up to this time we were unable to find any cause for the condition and were quite in the dark as to the aetiology. The mercury treatment was stopped after a week as her Wassermann reaction was negative.

Some weeks after her discharge from hospital it was discovered by a mere chance that she had recently undergone a course of antirabic treatment at the Pasteur Institute, Rangoon, and that her sight became affected about five or six days after her last antirabic injection. She had not connected her eye trouble with the antirabic inoculations and had therefore not reported it to the Pasteur Institute, nor mentioned the inoculations at the hospital.

Details of Antirabic Treatment.—The patient, a healthy, normal woman, was bitten by a dog, which was certified rabid, on March 3, 1932. She reported at the Pasteur Institute, Rangoon, on March 5, two days after the injury.

There was one deep bite on the arm, inflicted through the bare skin; the wound had been cauterized with pure carbolic acid.

*First published in the *Indian Medical Gazette*, August, 1933.

She was given Class III treatment, *i.e.*, 5 c.cm. of a 5 per cent. carbolized sheep vaccine, for 14 days, receiving in all 3·5 grammes killed sheep fixed virus. She attended regularly from March 5 for her treatment, which was completed on March 18, 1932.

No untoward symptoms whatever were observed during the course of treatment.

A few days ago (April 4, 1933) her eyes were examined again. This is just over one year since the disease started. Except for the small scotoma her eyes are normal. There is no peripheral contraction of the fields. The optic discs are of a healthy pink colour. Edges distinct. Good physiological cups with cribriform plate well shown at the bottom of them. The blood vessels are normal. At no time were there any exudates or haemorrhages. The latter were looked for even with a red-free light. Right vision 6/5 and J.1. Left vision 6/5 three letters; J.1 slowly but accurately.

Discussion.—The question as to whether this case is an example of the so-called "post-inoculation paralysis" is an interesting one. As is well known, antirabic inoculation is occasionally followed by disorders of the nervous system which, though their aetiology is still undetermined, have undoubtedly a causal connection with the inoculation.

These nervous disorders present a great diversity of form, varying from slight weakness of one or both legs, or simple facial paralysis in the mildest cases, through a more severe condition with complete paraplegia, to a very grave and exceptionally fatal ascending paralysis of the Landry type.

Such are the forms in which these disorders are usually manifested, but affections of almost every part of the nervous system, including the various cranial nerves, have been reported.

A careful search of all available literature has failed to bring to light any case similar to this one, in which the part of the nervous system affected was the optic nerves themselves, but there seems no reason to suppose that this part of the nervous system should necessarily be exempt from attack by a disease whose incidence on that system is so wide-spread.

In a personal communication to one of us, Lt.-Col. H. E. Shortt, I.M.S., Director, Pasteur Institute of India, Kasauli, states that he recollected seeing a report in which optic neuritis, or at any rate blindness, had been observed in animals after antirabic treatment; but he, too, was unable to find the actual reference.

The following points are in favour of this case being one of post-inoculation paralysis:—

First, the fact that no other cause for the condition could be discovered, at a time when nothing was known as to previous antirabic treatment.

Secondly, the incubation period—about 20 days from the first treatment—corresponds with that observed in cases of post-inoculation paralysis, practically all, if not all, of which occur within the first thirty days, reckoning from the date of the first treatment.

Thirdly, remarkably complete recovery from such a severe condition. Except in the gravest cases and those of the Landry type, the prognosis of post-inoculation paralysis is good, and the tendency is to complete recovery after a longer or shorter period. In this case, serious as the damage appeared to be, both eyes had returned practically to normal in little more than two months.

OXYCEPHALY IN BROTHERS

BY

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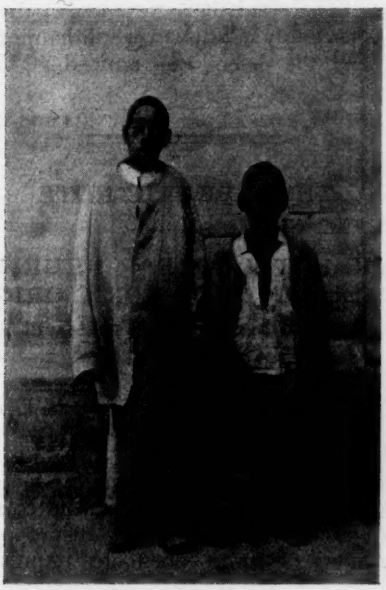
LAHORE

AT the end of February, 1933, two boys were brought to the ophthalmic department of the Mayo Hospital, Lahore, Punjab, for a very uncommon defect of the eyes. These two boys were brothers, the younger one aged five years, and the elder aged eleven years.

On examination, I found that both the boys were cases of oxycephaly, their skulls being fairly typical of that condition, as can be seen from their photographs. Their palates were highly arched.

Both of them had fairly well marked bilateral exophthalmos. Both of them had well marked bilateral ptosis, with inability to raise their lids. This interfered with vision to a great extent, so that if they wanted to look at something, they invariably lifted up one lid with the fingers. In fact, the younger of the two went about most of the time with one finger on one or other of the lids to raise it.

In both, the eyes were fixed in the middle line, and there was complete inability to move the eyes in any direction whatsoever,



with the result that if they wanted to look anywhere except straight in front they had to move the head.

In each case the vision was practically normal in both eyes. The media and fundi were normal. The fields of vision taken roughly with the hand—a perimetric examination not being possible—were fairly normal.

The boys presented no other abnormality. They came of very poor parents and they had the normal intelligence of their class. The elder one was working with his father in a brick kiln.

As regards the family history, their parents were quite normal. They had two brothers, one younger whom I saw, and one older whom I did not see. The younger one, aged two years, was quite normal, and I am told that the elder one as well as two sisters was quite normal.

I have seen cases of oxycephaly before, but this is the first instance in which I have seen two brothers suffering from the same defect. Exophthalmos is usual, but this is the first instance in which I have seen ptosis with fixation of the eyeballs in the centre, and complete lack of movements of the eyeballs in any direction.

I am unable to lay my hands on all the literature on oxycephaly and hence do not know if such a defect has been recorded before. In any case I think the cases are rare enough and worth recording.

The question arises as to whether the ptosis and fixation of the eyeballs was due to mal-development of the muscles or the nerves. It seems to me that the defect was in the muscles. Lack of movement was certainly not due to exophthalmos. The condition was congenital, and the defect was noticed at birth. Skiagrams were of no help.

THERAPEUTIC NOTE

CHRONIC RETROBULBAR NEURITIS AND AMBLYOPIAS OF TOXIC ORIGIN

A New Method of Treatment

BY

N. N. RAY, M.B., D.O.M.S.(Lond.)

LATE HON. OPHTHALMIC SURGEON, CAMPBELL HOSPITAL, CALCUTTA

IN course of hospital and private practice oculists come across a number of cases with impaired vision, the correction of whose refractive error, usually small and very disproportionate in comparison to the defect of sight—does not improve the vision at

all, nor does the fundus oculi usually show any abnormality on ophthalmoscopic examination. As a rule these cases are disposed of, with the remark, "Eyes amblyopic, no improvement with glasses." Some of them are put on a mixture of pot. iodide and liq. hydrarg. perchlor. for some time—and as the patients do not experience any improvement, they discontinue the mixture and are left to their fate. Owing to the serious defect of vision, they cannot earn their living and thereby live a life of enforced idleness, become a burden to their family and a great economic loss to the community.

During the last four years I have made a careful clinical study and investigation of these cases and discovered a new method of treatment which has given remarkable results in over 150 cases. My series did not include tobacco and quinine amblyopias, but consisted mainly of cases of poisoning by heavy metals and acute infectious diseases.

If after examination of the fundus, visual fields and refraction, a case is diagnosed as retrobulbar neuritis or toxic amblyopia, the patient's blood is examined for the Wassermann reaction, which must be negative for the purpose of this treatment, and also the urine must be free from sugar and albumen. The above conditions being satisfied, the patient is given a course of six deep intramuscular injections of "contramine" in the gluteal region; ·05 to ·25 gm., according to the age, every 48 hours. Thereafter the patient is put on a mixture of glycerophosphates and strychnine, such as "metatone" (P. D. & Co.) or Huxley's syr. glycerophosphates co., dr. 2, thrice daily after meals. If a septic focus is found, as in teeth, tonsils and other sources, appropriate medical treatment or surgical intervention is instituted first. As a rule, the patient finds marked improvement in vision, both central and peripheral, after the injections, and the glycerophosphates and strychnine mixture improves the visual fields still further. I have tried, as a control, the above mixtures only, but no "contramine" injections, without the least benefit; but the same cases, with the injections later, improved remarkably.

"Contramine" is an organic sulphur compound manufactured by the British Drug Houses, Ltd., London. Reading the literature in which the manufacturers say that the drug is very useful in chronic infections and intoxications, I conceived the idea of applying it in the treatment of eye diseases in which chronic infections and intoxications seemed to be the causative agents; with what results the reader may judge for himself.

Contra-indications:—I have found from personal experience that this drug is absolutely useless in chronic retrobulbar neuritis or amblyopia caused by disseminated sclerosis, diabetes and syphilis, unless the Wassermann reaction is negative after anti-syphilitic treatment; and also in amblyopia ex anopsia. Hence it should not

be used in these cases nor in cases where the patient has or had nephritis in any form, or arteriosclerosis; the drug may prove dangerous in nephritics or in persons who are addicted to alcohol for a long time. After an injection of "contramine" the patient should abstain from alcohol for at least 12 hours. Under no circumstances should "contramine" be injected into a vein. Dosage:—Children and young adults should be given ·05 gm.; adult females require ·125 gm. generally per injection; adult males of robust constitution ·25 gm.; even then the initial dose may be ·125 gm. The dose should be judged according to the weight and constitution of the patient. Overdosage may give rise to salivation, giddiness, nausea, purging and headache; one or more of these symptoms may be found in a case; they indicate that the dose should be reduced at the next injection. Usually these symptoms are of no consequence and pass off in a few hours' time.

The success of the treatment depends on careful selecton of cases and correct diagnosis; I had three failures, which, on further investigation, showed that the original diagnosis was wrong. The treatment should not be undertaken by anyone who is not an expert ophthalmologist. The drug itself may prove dangerous if not carefully used, especially in patients with any form of nephritis or arteriosclerosis.

I consider that with further investigations and experiments the use of "contramine" in ophthalmic practice may be still more extended, specially in those cases of syphilitic retrobulbar neuritis or partial optic atrophy in which the Wassermann reaction has been rendered negative by anti-syphilitic treatment, but with the visual defects still persisting.

ABSTRACTS

I.—PATHOLOGY

(1) **Sanyal, S. (India).—Study of a case of melanosis oculi.** *Calcutta Med. Jl.*, Vol. XXVIII, No. 1, July, 1933.

(1) **Sanyal** describes the case of a medical student, aged 23 years, who consulted him for headache. The right eye presented a marked example of pigmentation of the sclerotic, which is well figured in the rather diagrammatic, coloured illustrations which accompany the article. The pigmentation was most intense towards the cornea, it reached practically to the limbus and faded as it proceeded backwards. The colour in most places was slate-blue, but there were three areas which presented a brownish-blue

appearance. The posterior edge of the pigmented area was serrated. The conjunctival vessels were less conspicuous than usual over the coloured area. There were also three areas of brown pigmentation in the conjunctiva; two on the edges of the upper and lower lids and the third on the temporal part of the globe in the palpebral aperture. The iris of the right eye was found to be more heavily pigmented than that of the left. After dilatation with homatropine, 2 per cent., the right pupil took two days longer to return to its normal shape than did the left.

Slit-lamp examination showed that the pigmented scleral area consisted of several individual areas of brown pigment, of elongated shape and varying in size. These were roughly parallel to each other and seemed to follow the scleral fibres. The mosaic of pigmented areas was set on a light brown background of the sclera, as is well shown in the coloured plate. Vision was normal, and the eye was otherwise healthy, save that the fundus looked grey in one part. The right side of the face was more heavily pigmented than the left, and there were other areas of the skin which showed associated pigmentation. The patient was the fifth of a family of five and was said to be the blackest of all the children. The parents were fair. No other relative was known to show this pigmentation.

Blood examination showed that the blood sugar was unusually low for a Bengali, far short of the average; whereas N.P.N. was greater than the minimum and tended to rise towards the maximum. Urea Nitrogen also showed the same tendency as N.P.N.

Photometric studies did not reveal any essential change in light difference. It followed Weber's law. The only change found was in the light minimum, which was raised.

An unusually full bibliography of 48 items accompanies this interesting paper.

R.R.J.

(2) **Samuels, Bernard (New York).—Significance of specific infiltration at the site of injury in sympathetic ophthalmia.** *Arch. of Obhthal.*, April, 1933.

(2) **Samuels** begins his paper with a short résumé of current theories as to the cause of sympathetic ophthalmitis, and shows that although every effort has been made by bacteriologists to discover the exciting micro-organism, the results have been negative. In spite of this, however, it is a disease which manifests itself after the globe has been opened, and rarely occurs under any other circumstance. In the present paper, Samuels is concerned with sections of 101 eyes "in which the specific infiltration of sympathetic ophthalmia was found." When organisms invade the body they may pass through the portal of entry without lodging there—as in malaria; they may remain at the portal of entry and produce their effect by virulent toxins, as in diphtheria; or a combination of the

two processes may occur when some organisms stay at the portal of entry and others are carried off by the circulating lymph or blood. It is possible for a primary infection to occur with or without a primary lesion. The failure to find a primary lesion therefore proves nothing, but the discovery of a single primary lesion is of the greatest significance. Of the 101 cases, it was possible to obtain sections going through the area of the wound in 81, and of these, in 58, the infiltration was of about the same amount throughout the uvea. In two cases there was infiltration only at the site of the wound, and in nine cases the infiltration here was overwhelmingly greater than in other parts of the uvea. Two cases showed an absence of infiltration round the wound and 10 showed less infiltration there than elsewhere. The author feels justified therefore in concluding that his results speak in favour of sympathetic ophthalmitis being caused by a bacterium whose portal of entrance is an opening in the eyeball. In the discussion Jonas Friedenwald stated that if uveal pigment was injected into the subcutaneous tissues, the reaction was very slight. In two patients with sympathetic ophthalmitis, however, there was a marked reaction with formation of masses of epithelial cells extending 2-3 mm. away from the site of the pigment. Microscopic examination of these areas revealed a histological picture practically indistinguishable from that seen in the uveal tissue in sympathetic ophthalmitis.

F. A. W-N.

(3) **Naffziger, Howard C. (San Francisco).—Pathologic changes in the orbit in progressive exophthalmos.** *Arch. of Ophthal.*, January, 1933.

(3) **Naffziger's** paper concerns six patients who had exophthalmic goitre and in spite of thyroidectomy suffered from progressive proptosis. Some of them also developed paresis of the extra-ocular muscles, and intra-ocular changes consisting of papillitis, optic atrophy, and retinal haemorrhages. The treatment was removal of the roof of the orbit and that of the optic foramen by an intracranial approach, the orbital fascia and the ring of Zinn being opened "for purposes of decompression." In every case the extra-ocular muscles were found to be enormously enlarged from three to eight times their normal size, and were of firm, sometimes rubbery consistence. The latter cases showed hyaline degeneration. Portions of the muscles were removed for histological examination and showed swelling of the fibres with loss of striation and interstitial oedema. In later stages, there was proliferation of round cells, going on to formation of scar tissue. Of the six cases the operation was bilateral in four. There were no deaths, the proptosis gradually lessened, the process continuing for several months, and in each instance, there were early improvement of vision, subsidence of

papillitis and disappearance of the haemorrhages. The globes showed faint pulsations of which the patient was unaware. In the early part of his paper, the author quotes from the literature various hypotheses as to the cause of proptosis in Graves' disease, *e.g.*, vascular engorgement, accumulation of fat, sympathetic irritation causing contraction of Müller's muscle, but feels justified in claiming enlargement of the extra-ocular muscles as the principal cause.

That this is not always the cause however was shown by Jonas Friedenwald in the subsequent discussion when he mentioned seven cases of exophthalmic goitre which came to autopsy. In six the extra-ocular muscles were perfectly normal but the seventh showed the changes described by Naffziger. Benedict reported that at the Mayo Clinic, the combined use of thyroxine and a compound solution of iodine kept exophthalmos under control to such a degree that operative interference was not required. The author in conclusion likened the muscle changes in Graves' disease to those found in myasthenia gravis.

F. A. W-N.

(4) **Holm, Ejler (Copenhagen).—A case of orbital plasmocytoma.** *Acta Ophthal.*, Vol. X, p. 334, 1932.

(4) Plasmocytomata are tumours generally originating from the bone marrow. Clinically they behave like multiple myelomata, from which they differ microscopically. Some forms readily give metastases. Plasmocellular formation in connection with the conjunctiva has been described by Pascheff and Rund; Morax has described it affecting the skull and frontal and ethmoidal sinuses. **Holm** adds to this by a full account of a woman, aged 73 years, with a tumour of the left orbit. Histological examination after extirpation showed it to be a plasmocytoma. Subsequently a mass on the right wrist developed and ten months later the right orbit became affected and led to the death of the patient after a year in spite of X-ray treatment. At post mortem no metastases were found. The origin of the tumour could not be detected.

ARNOLD SORSBY.

(5) **Cocuzza (Catania).—A case of cysticercus in the upper lid. (Sobra un caso di cistícercosis réscontrata sulla palpebra superiore di un uomo adulto).** *Lett. Oftal.*, February, 1932.

(5) Cysticercus may be met with anywhere in the body, but it is rare to meet with one in the upper lid; in this case the patient was an Arab. The mass was noticed as a rounded elastic swelling in the lid, not attached to any deeper part. **Cocuzza** excluded the commoner tumours of this situation, and taking into consideration the frequency of cysticercosis in Cyrenaica, suspected the possibility of a cysticercus. This was proved by histological examination.

HAROLD GRIMSDALE.

II.—OPERATIONS

(1) **Key, Ben Witt (New York).—Extensive iridodialysis; operative reattachment.** *Arch. of Ophthal.*, May, 1932.

(1) Although the iris in cases of minor degrees of iridodialysis may become reattached under the influence of atropine, larger defects are unaffected. **Key** has operated on two cases with successful results. The technique is as follows. A keratome incision 4 mm. long is made at the angle of the anterior chamber opposite the dialysis and a small flap of conjunctiva and sclera is obtained. One needle of a double armed suture (000 French silk) is then passed through the detached portion of iris at its base. In order to do this, the iris is grasped with forceps and pulled slightly out of the wound. Both needles are then made to traverse the small sclero-conjunctival flap and are tied, with sufficient tension to displace the pupil slightly towards the wound. Atropine is instilled and both eyes are covered. The stitch is removed on the fourth day and the patient is kept in bed for a further 48 hours.

F. A. W-N.

(2) **MacMillan, J. A. (Montreal).—Transplantation of the lacrimal sac in chronic suppurative dacryocystitis.** *Arch. of Ophthal.*, December, 1932.

(2) **MacMillan** describes what seems to be a simple and effective operation for the relief of chronic dacryocystitis. It consists in exposing the sac, freeing it anteriorly and posteriorly by dividing the lacrimal fascia and then cutting it across transversely at its entrance to the canal. A stout silk suture is passed through the fascia and outer wall of the sac and the latter is lifted up so as to expose the floor of the fossa. A punctum dilator is used to perforate the lacrimal bone high up, near the median palpebral ligament (which is not divided) and the hole is enlarged with the blunt end of the dilator up to a diameter of 3-4 mm. The ends of the silk suture are then passed through the opening into the nose, and picked up by a pair of nasal forceps, brought out of the nostril and tied over a piece of gauze. The skin incision is united by sutures and a dressing applied. The nasal plug is changed on the second day and removed completely on the fifth day, when the sac suture may also be withdrawn and the skin sutures removed. The operation is carried out under local anaesthesia, the nasal mucous membrane being rendered anaesthetic by insertion high up under the anterior end of the middle turbinate of a pledget soaked in 10 per cent. cocaine and epinephrine. Of 16 patients after two years, 10 were cured, 3 were improved, and 3 were failures. The

operation may be rendered difficult by variations in the floor of the lacrimal fossa. In a minority of cases, about 20 per cent., it is made up entirely of the frontal process of the superior maxilla and when this occurs, a drill or burr is required to obtain an opening. When the lacrimal bone forms part of the floor, however, it is easily perforated in the manner described.

F. A. W-N.

(3) **Mott, Walter C. (Albany, New York).—Muscle recession with tendon stump and Tenon's capsule fixation.** *Arch. of Ophthal.*, December, 1932.

(3) **Mott** describes an interesting modification of the usual operation of recession. The conjunctival incision is made vertically over the approximate line to which the muscle is to be receded. The latter is carefully freed from its lateral attachments to Tenon's capsule, grasped in Prince's forceps and the insertion cut through leaving a stump about 1 mm. long. A mattress suture is passed through the posterior conjunctival lip from without inwards, then through the muscle 1 mm. from its cut end on through the stump of the tendon and out through the anterior lip of the conjunctival wound. The distance between the cut ends of the muscle is regulated by the tightness of this suture, which is varied according to the effect required. The sclera and the overlying muscle are curetted in order to promote adhesion and lateral sutures are then introduced to reunite the muscle and the portions of Tenon's capsule bordering it above and below.

F. A. W-N.

(4) **Marchesini (Genoa).—Electrolysis in partial trichiasis and the accompanying pain. (Trichiasi parziale, elettrolisi di ciglia e sensibilita elettrolitica).** *Arch. di Ottal.*, March, 1933.

(4) Where only one or two lashes are inverted, the most suitable surgical treatment is to destroy the hair follicle, and this may best be done by electrolysis; unfortunately the pain of this procedure is sufficient to prevent its general adoption. **Marchesini** has investigated the subject of this pain which is not averted by any of the common local anaesthetics.

To the application of most of these, the pain seems entirely indifferent; it is slightly reduced by the injection of a 5 per cent. solution of cocaine hydrochlorate and also by a similar solution of the bichlorhydrate of quinine and urea.

Even when the trunk of the sensory nerve seemed entirely paralysed by an injection in its course, the pain persisted though all other sensation was completely lost.

The author finds that the pain is situated close to the negative pole. He has investigated the possibility of the pain being due

to the electrolytic formation of acid or alkali by injecting immediately before the passage of the current, a solution in one case of acid in another of alkali, thinking that this would neutralise the new formed substance if it was of such contrary nature, and has found the pain unaltered. He concludes that this sensibility is a special sense, which requires a special anaesthetic, at present unknown for its relief. When this has been found, electrolysis will no longer be attended with pain and will be the method of election for the treatment of partial trichiasis.

HAROLD GRIMSDALE.

(5) **Worms, M. G. (Val-de-Grâce).—Decompressive trephining of the optic canal. (La trépanation décompressive du canal optique).** *Arch. d'Ophtal.*, April, 1932.

(5) **Worms** reports four cases in which, in the course of exposure and curettage of the posterior ethmoidal cells, he resected the median border of the optic foramen, exposing the dural sheath, for the relief of pressure on the optic nerve.

In three cases presenting severe papillitis with rapid deterioration of vision, recovery of sight quickly ensued; in the fourth case, one of optic atrophy of obscure origin, visual acuity which had been failing progressively, remained stationary for at least three months.

"The value of this procedure"—which is comparatively easy of execution—"can only be determined by a much more extensive experience." It is based on the same principles as is decompressive trephining of the cranium, or of the eyeball in glaucoma.

The operative technique is fairly simple; the author's description thereof, with two diagrams, should be consulted by those desirous of adopting this surgical intervention.

J. B. LAWFORD.

(6) **Koch (Padua).—Worms' operation for decompressing the optic foramen. (La trapanazione decompressiva del canale ottico secondo Worms).** *Ann di Ottal.*, August, 1932.

(6) In certain cases of optic neuritis, the seat of the pressure on the nerve has been diagnosed as situated in the optic foramen and operations have been proposed to relieve it by removing some part of the bony wall. Worms states that it is possible to reach the part by an incision along the inner orbital wall and working through the ethmoidal cells to the anterior margin of the optic foramen, at a distance of 1 cm. behind the posterior ethmoidal foramen. This part of the bone is forcibly displaced. **Koch** shows that this method would reach only the groove which runs forward from the optic foramen and would leave the bony canal intact. The operation therefore could not succeed in its intended aim.

HAROLD GRIMSDALE.

(7) **Bardanzellu (Genoa).—A new operation for treatment of subcutaneous angiomata of the face. (Un nuovo metodo di trattamento chirurgico degli angiomi sottocutanei del viso).** *Arch. di Ottal.*, December, 1933.

(7) The patient in this case had a large disfiguring angioma of the cheek. It was important to devise an operation which would involve little scarring, and at the same time would not require repetition. **Bardanzellu** passed a number of loops of sterile catgut through the tumour and buried them. They excited a certain amount of reaction which produced constriction of the vessels and a rapid diminution and finally disappearance of the tumour.

HAROLD GRIMSDALE.

III.—MISCELLANEOUS

(1) **Tirelli (Bologna).—Permanent tolerance of an iron fragment in the region of the ciliary body, with siderosis of the lens. (Tolleranza assoluta di un corpo estraneo di ferro nella regione del corpo ciliare con siderosi del cristallino).** *Ann. di Ottal.*, July, 1932.

(1) In the case recorded by **Tirelli**, a man was struck in the eye while at work, by a small fragment of iron; his sight was immediately much reduced but returned within two or three days almost to normal. The surgeon who examined the eye at the time of the accident did not appreciate the fact that a foreign body had penetrated the eye and regarded the injury as "simple conjunctival hyperaemia." Some months later the sight began to fail and the man came under Tirelli's observation.

There was then found a small linear scar at about "10 o'clock" on the corneal margin and a corresponding wound of the iris. There had been no redness or pain at any time. The lens showed a uniform reddish reflex; the surface of the capsule being covered everywhere by very minute red-brown granules.

The most careful radiogram showed no foreign body. The author hazards the suggestion that it had been completely dissolved. No part of the eye except the lens showed any change.

HAROLD GRIMSDALE.

(2) **Quaglio (Padua).—The effect of the ultra-violet rays on visual acuity. (L'azione del raggi ultravioletti sull'acutezza visiva).** *Ann. di Ottal.*, August, 1932.

(2) It has been generally assumed, says **Quaglio**, that the presence of ultra-violet rays in light has the effect of reducing the visual acuity, but there has been no experimental proof of this.

He has investigated the matter, illuminating the test-type by light containing much ultra-violet rays, and testing the acuity. This known, he introduces filters which cut off the ultra-violet light, and after increasing the illumination on the type, in proportion to the diminution caused by the filter, he has remeasured the acuity. It is necessary to make the adjustment in the amount of illumination, since the acuity depends largely on this; when the adjustment is accurately made, he finds that there is always an increase, slight in some cases, considerable in others, in the acuity when the ultra-violet light is excluded. The author explains the observation as follows: the lens fluoresces under the action of ultra-violet rays and the light emitted by the lens will fall on the macula and to some extent blur the retinal image.

HAROLD GRIMSDALE.

BOOK NOTICES

Psychological Factors in Peripheral Vision. By G. C. GRINDLEY, B.Sc. Issued by the Medical Research Council. Reports of the Committee upon the Physiology of Vision. H.M. Stationery Office. 1931. 1/- nett.

The author reviews briefly the differences between direct and indirect vision; the physical factors causing distortions and blurring of the image on the retina produced by the oblique incidence of the light from an object seen indirectly on the refracting surfaces of the eye and on the retina; the retinal factors, such as the changes in the distribution of the rods and cones in passing from the fovea to the ora serrata; and central factors of a physiological and psychological nature.

This paper describes a series of experiments which throw some light on the central factors involved in peripheral form perception, in particular the psychological processes. The problems studied are (1) The peripheral perception of complex figures. (2) The influence of the time of exposure on the accuracy of peripheral form perception. (3) The influence on peripheral perception of directing voluntary attention to various parts of the visual field. (4) The judgment of the position of a peripheral object. The apparatus used in these experiments is described in detail. The observers were shown any of a large number of figures of varying complexity at known points in the periphery of the visual field. After each exposure they described what they had seen and gave an account of their conscious processes. Six psychologists acted as observers and about 800 readings were taken and a few readings were also made with untrained observers, such as casual visitors to

the laboratory. Although the latter made the same kinds of error as the former it was difficult to obtain introspective reports from them. The length of exposure was 1/10 second in most instances.

Details of some common errors in peripheral perception are given and of the alteration in the appearance of a figure with changes in eccentric angle. The influence of past experience and expectation, conscious processes in peripheral perception and the variability of the results are discussed.

Experiments were devised to show the effect of time exposure, the influence of attention and the judgment of the position of a peripheral object.

The author states that the experiments described in this paper do not show that the cerebral factors involved in peripheral form perception are radically different from those operating in direct vision. The experiments suggest that owing to the blurred nature of peripheral vision (produced by retinal and physical factors) cerebral processes are more likely to introduce mistakes and illusions into peripheral vision than into perception by direct vision. Mental attitudes such as attention and expectation were found to have an important influence on peripheral perception. The significance of the illusion of position of objects in the peripheral field is discussed in connection with motor-car driving. The experiments showed that the perception of form becomes less accurate as the eccentric angle at which it is exposed is increased. Large forms of simple structure are more easily perceived than those having opposite characters.

Past experience of experiments of this kind and expectation of the type of object to be shown influences the observer's answers. An initial impression of one kind is sometimes followed by a second impression of a different kind.

An increase in the time of exposure increases the probability of an accurate report. These and other experimental results the author carefully discusses. He points out that it is often difficult to separate the effects of physical, retinal and cerebral factors or to give any definite account of the cerebral processes involved.

The report is a further contribution to the study of peripheral vision, a subject upon which the Medical Research Council have already published one report. (No. 136 in this series.)

Transactions of the American Ophthalmological Society. Vol. XXXI. 1933.

This attractive volume of nearly 600 pages gives the papers read at the 69th Annual Meeting of the Society at Washington last year.

Besides interesting papers on clinical ophthalmology there is evidence of research in the papers by Yudkin and Gilman entitled "The osmotic equilibrium between blood and intra-ocular fluid as

influenced by anisotonic injections: clinical significance"; Adler, in a paper on the nature of the aqueous humour, concludes that the aqueous cannot be a dialysate; while Jonas Friedenwald and Pierce contribute an interesting note on "The respiratory function of the aqueous." These three papers were discussed together.

We hope to notice some of the work contained in this volume in our abstract section at a later date. The volume, as a whole, appears to us to be of more than usual interest.

Problems in the Education of Visually Handicapped Children. By R. VICKERS MERRY, D.E., Harvard. Pp. 243. Oxford University Press. 1933. Price, 13/-.

Until quite recent years discussion of the methods of training children with little or no sight was confined to ophthalmic surgeons. Now the educationalists are taking a considerable interest in the matter. Symptomatic of this interest is the volume published in the series of Harvard Studies in Education, written by Ralph Vickers Merry, consultant in Child Guidance, Dayton, Ohio. It was his thesis for the requirement for the degree of Doctor of Education of Harvard University. If this work indicates the general level of theses presented to the University for its doctorates, then the level is a high one. The book is excellent, well-written, critical in spirit, and balanced in judgment.

The author's aim has been to indicate and discuss problems needing investigation, and to assist teachers of visually handicapped children to a clearer understanding of theories and objectives. He estimates that there are in the States 14,400 persons blind under the age of 20 years of whom only 6,000 are being educated in schools for the blind. In addition, there are 50,000 partially-seeing children only 5,000 of whom are receiving instruction in sight-saving classes.

Less than 150 years ago nothing was done for the blind. At best the attitude of the people was "pity the poor blind." The XVIIIth century French philosophers speculated on the mentality of the blind, but they did nothing. Valentin Haüy, moved to pity by the shocking exhibition of blind persons to attract custom to a café at a fair, determined to help them. He started a school in Paris in 1784. By chance he noticed that one of his best pupils felt print that had pressed too deeply into the paper. That led him to devise embossed type and opened a new world for the blind. England and Germany followed the example, and America did so in 1829. Now every state in the Union has its blind schools or makes suitable arrangements. A sight-saving class was opened in Boston, U.S.A., in 1913, after Edward E. Allen, Director of the Perkins Institution, had made a visit to the "myope classes" which had been started in London in 1908. There were 350 of

these classes in the States in 1930 (a later publication gives the figure of 413 in 1932).

Merry finds no clear statement of the objectives of elementary education for blind children. It is implied that this should be one of preparation for vocational training or for higher education. He considers the value of manual training may have been greatly overemphasized. "The claim that it stimulates the brain cells through motor activity and that it is valuable prevocational training can hardly be justified according to modern theories." On the other hand the aims of the sight-saving schools are clear: first, to provide instruction with a minimum of eye strain; then to teach pupils how to conserve their vision; and lastly to provide suitable vocational guidance, and, if necessary, vocational training. He finds that while sight-saving classes are not beyond criticism, they are more advanced than are many schools for the blind, because the former always have been recognized as part of progressive public school system and have conformed to current standards.

Discussing blind children, he considers that under normal circumstances home environment for young blind children is preferable to that of an institution. Parents, however, must be assisted to an intelligent attitude towards their handicapped child. From the standpoint of socialization the instruction of blind children in day schools is preferable to their education in residential institutions. In scattered communities the latter may be necessary. He notes a tendency for the proponents of each system to base arguments upon *ideal* conditions, rather than upon those which actually exist, but in general there is recognition that day schools and resident homes must supplement rather than attempt to supplant each other.

He finds the general intelligence of blind children somewhat inferior to that of the seeing in that there are fewer superior and more inferior individuals among the former. Surveys show the blind to be one to three years below the seeing in achievement. There are no adequate provisions for the feeble minded or mentally retarded blind. Some tests of the partially-seeing children indicated that they may be somewhat inferior in intelligence, but they seem quite superior when classified according to teachers' judgments. It is admitted no satisfactory intelligence test for partially-seeing children has been devised. Serious visual defects among school children frequently result in repeated failure which, in turn, produces a sense of futility and a feeling of inferiority in the pupil. The sight-saving class provides a means of substituting successes for failures, thus removing the primary cause of the disturbance. He considers the mental-hygiene aspects of sight-saving classes, are of major importance, and should not

be overlooked. Next to this probably the most important function of these classes is the formation of habits of ocular hygiene, and the influencing of pupils towards the choice of a vocation which will not make too great demands upon their vision.

Discussing the teachers, he considers much of the backwardness of the blind schools is due to the absence of special training of the teachers. These should have training in the psychology and education of the blind, and three or four years of successful experience with seeing children. Teachers of sight-saving classes are better provided for, since 1921 many courses of instruction have been given at various colleges, universities, and normal schools throughout the country.

He is insistent that his examination of this problem shows the need for experimentation and research. The field should be valuable to the research worker, as the majority of its problems are as yet untouched. He warns the authorities not "to expect bizarre and sensational results, and to regard research as a form of publicity rather than as a slow, diligent, and non-spectacular search for truth."

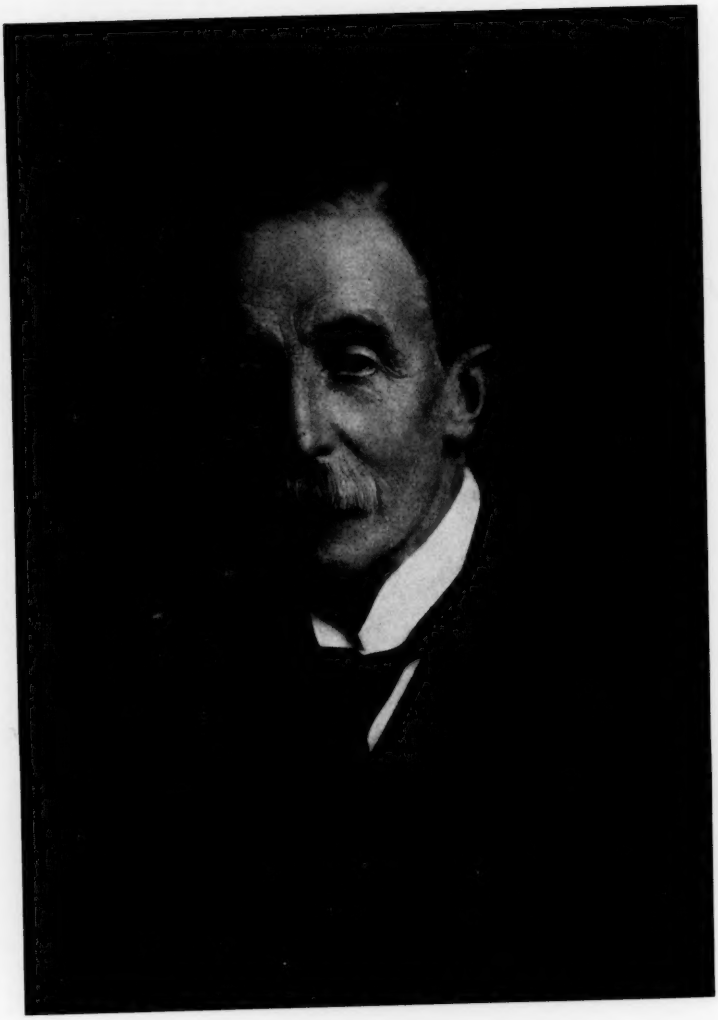
This book will be of value to all interested in the care of the blind, whether they be medical practitioners or laymen.

N. BISHOP HARMAN.

OBITUARY

JOHN BOWRING LAWFORD

THE death of Mr. Lawford, briefly alluded to in our last number, deprives British Ophthalmology of one of its outstanding members and his friends of a very lovable personality. Though he retired from practice rather more than four years ago, his interest in ophthalmology was as keen as ever, and his mental outlook still that of a young man. This journal will miss him sorely. Lawford was the son of Mr. Frederick Lawford, of Montreal, and was born there in 1858. Educated in that city and at McGill University, he graduated M.D., C.M. in 1879 and immediately sailed for London. Here he joined the school of St. Thomas's Hospital and took the M.R.C.S. in the same year. After holding the usual resident posts at St. Thomas's, he was for a time resident assistant at Bethlem Hospital. He next enrolled as a student at Moorfields, where he held the posts of house-surgeon and curator of the museum. Thence onwards ophthalmology claimed his chief interest. He passed the examination for F.R.C.S. Eng. in 1885,



JOHN BOWRING LAWFORD

and in the following year was elected assistant ophthalmic surgeon to St. Thomas's; his chief being the late Edward Nettleship. In 1890 he joined the honorary staff at Moorfields.

On the foundation of the Ophthalmological Society of the United Kingdom in 1880, Lawford became an original member; and from volume 2 to the last volume hardly a year passed without the transactions containing some contribution from his pen. In proposing a vote of thanks to Sir Arthur Keith for his Bowman Lecture at the jubilee of the Society, he recalled the fact that he was one of the few original members left who had sat at the feet of Sir William Bowman. The last time the writer met him was at the Annual Congress last year, which he attended in spite of the unsatisfactory state of his health.

The later volumes of the Ophthalmic Hospital Reports contain many papers by him from the time of his curatorship to the penultimate volume. Among these his papers on hereditary glaucoma are specially worthy of note.

Lawford became surgical secretary of the Ophthalmological Society in 1895, and held this post for the statutory period of three years. He served on the council and from 1906-1910 was treasurer of the Society. In 1911 he was elected President and chose as his presidential address the subject of inoculation treatment in diseases of the eye.

His long connexion with Nettleship had made him a master clinician. He was never tired of expatiating on the advantage it had been to him to have been trained by such an accurate observer and tireless worker. He assisted Nettleship in his private practice and was present to help at the extraction of Mr. W. E. Gladstone's cataract. He wrote the obituary of his former chief for the *Lancet*, and contributed an admirable memoir of Nettleship to the memorial volume in the Treasury of Human Inheritance. This memoir was reprinted, by permission, in our pages, Vol. VII. Lawford was a member of the editorial staff of the Ophthalmic Review for many years, and acted as editor-in-chief for two periods in the history of that journal. In our last number we tried to express the great debt which this journal has owed to him from its beginning.

As we mentioned in our annotation last month, Lawford was elected Chairman of the Editorial Committee of the Journal in 1916, and almost immediately became senior Managing Director of the Company, which post he resigned in 1926. His previous experience as Editor of the Ophthalmic Review for many years was invaluable to the Editorial Committee of which he was a very active member.

In later life Lawford did a great deal of notable public work. He was chairman of the Council of British Ophthalmologists

and an active and energetic member of the Prevention of Blindness Committee, the Union of Counties Association for the Blind, and the National Lending Library for the Blind. With his colleague, the late Herbert Fisher, he took a large share in drawing up the certificate of blindness in connexion with the Blind Persons Act, and we know how much the members of the committee appreciated his services.

As an ophthalmic surgeon, Lawford was one of the most accomplished men of his time. His thorough training, coupled with high ideals and superlative conscientiousness, made his opinion on any ophthalmological subject always worthy of close attention. He conducted a large practice for many years, and both in private and hospital work made a host of friends and admirers, who were impressed by his obvious sincerity and his hatred of slackness and shoddy work of all kinds. He was an all-round man in his specialty. Gifted with marked manual dexterity, his operations were models of perfection. Never in a hurry; slow to change from established procedures to the latest "new thing" in treatment, he was, nevertheless, always up-to-date. The award of an Hon. LL.D. of McGill University in 1921 was a fitting honour for his *Alma Mater* to have bestowed on one of her most distinguished *alumni;* and it gave great satisfaction, not only to Lawford himself, but to all who knew him.

Among other honours accorded to him was one which he valued very highly, namely, the hon. membership of the Société française d'ophtalmologie. For years he was the principal liaison officer between French and British ophthalmology. His careful abstracts of papers from the *Arch. d'ophtal.* have been one of the most valuable features in our abstract section from the beginning.

In December last his health underwent a relapse, and it was thought prudent that he should give up all literary work for a time. This was obviously a grief to him. He wrote to announce the decision of his doctors and asked if any other reviewer could be found to take the *Arch. d'ophtal.* off his hands for a few months. It was characteristic of him that he retained the numbers which he had already received and had not been able to abstract, in the hope that he would be able to attend to such matters in the New Year.

Mr. Lawford was unmarried. For many years he made a home for his mother and sisters, first in London and afterwards in Ashtead in Surrey, where he died on January 3.

Sir John Parsons writes:—

Only those who came into intimate contact with Lawford in his work can fully realize the loss which he is to British Ophthalmology.

He was quite indefatigable, and his conscience would not allow him to decline any task, however arduous or uncongenial, if he considered it his duty to undertake it. It is to be feared that some of us, his colleagues on the staff of this journal, at times took undue advantage of his ever-ready help. The chief characteristic of his work was its thoroughness and meticulous accuracy. In this, as in so many other ways, he reflected the virtues of his great master, colleague, and friend, Edward Nettleship. His quiet and unassuming manner masked for many the extent and value of his contributions to science; but these are enshrined in the Royal London Ophthalmic Hospital Reports, the Transactions of the Ophthalmological Society, and in the pages of our Journal, and their reliability is such that they are safe foundations for others to build upon.

He had several very serious illnesses which he faced with imperturbable courage, returning to his work at the earliest moment—"baffled," perhaps,—but "only to fight better." As a personal friend he was the same quiet and undemonstrative individual, apparently shy and retiring, but with a backbone of resolution which was a sure support to all those on whom he conferred his friendship.

NOTES

Elsyngspital

THE foundation of a hospital or rather almshouse for 100 blind persons in the year 1329 A.D. is a matter of some interest in the history of ophthalmology. It was due to the munificence of William Elsing, mercer, of London. Founded on the site of an ancient nunnery in Gayspur Lane, near London Wall, it was known by the above title, and afterwards as Sion College. When Elsing made his will in 1348 he confirmed the gift of certain tenements, rents, etc., in the parishes of St. Alphege and St. Mary, Aldermanbury. The hospital at first consisted of a *custos* and four secular priests; but in 1340 the founder obtained a licence from the Bishop of London with the assent of the Dean and Chapter of St. Paul's, to change the secular canons into canons regular of the order of St. Augustine. The bishop added an extra canon, making five in all.

The hospital was dissolved by Henry the Eighth.

Elsing's will was proved in the Court of Husting, of the City of London. The fact that Thomas Morstede, surgeon to Henry the Fifth, made bequests in his will in 1450 to this hospital makes one

wonder whether he himself took any interest in the ophthalmology of his day.

The site is marked on the map of London, dated c. 1600, to illustrate Stow's survey. It is between Gayspur Lane, Philip Lane and London Wall and the church of St. Alphege occupies the North-east corner of the site.

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Royal London Ophthalmic Hospital, Annual Dinner

THE Annual Dinner of Past and Present Students of the Royal London Ophthalmic (Moorfields) Hospital, took place at the Langham Hotel on Thursday, February 8, 1934. Mr. Elmore W. Brewerton, consulting surgeon to the Royal Westminster Ophthalmic Hospital, was in the chair. Among other guests there were present: Sir Holburt Waring, President of the Royal College of Surgeons; Surgeon Vice-Admiral Sir Reginald Bond; Lieut.-Gen. Sir H. B. Fawcus; Sir Harold Morris; Sir William Lister; Lady Lister; Messrs. Edward Mellanby; E. P. Carter; Dryden Donkin; Theodore W. Luling, Chairman of the Hospital; Christopher Stone; K. G. R. Vaizey. There were also present Sir John Parsons, Messrs. R. Foster Moore, R. Affleck Greeves, Charles Goulden, Dean of the Medical School, and many other past and present students.

In replying to the toast of the School, the Dean stated that the School was in a flourishing condition and that there had been an increase in the number of students during the past year; that at the D.O.M.S. examination, of forty-four candidates from all sources, thirty had been successful, of whom twenty-six had worked at Moorfields. At the D.O. examination at Oxford, of the six successful candidates, four had worked at Moorfields. During the past year Mr. H. B. Stallard had joined the staff, and among the distinctions which had come to past students he mentioned that Dr. Gordon Holmes had been elected a Fellow of the Royal Society, that Sir Stewart Duke-Elder had been raised to the knighthood, and the K.C.V.O. bestowed upon Sir William Lister. Both Mr. Whiting and Mr. Goulden had delivered the Montgomery Lecture at the Royal College of Surgeons of Ireland at the invitation of the President and Council. Mr. G. Black had been appointed Ophthalmic Surgeon to the Leeds Royal Infirmary. Mr. Stallard had been awarded the Gifford Edmonds prize and that among the more senior past students, Mr. Mayou had been elected President of the Ophthalmological Society, and the Dean had been appointed a member of the University of London Board of Advanced Medical Studies.

Cours de Perfectionnement, 1934

THE Annual *Cours de Perfectionnement* will be held at the Hôtel Dieu from April 20 to May 15. Professor Terrien will be in charge, and will be assisted by numerous assistants. The course comprises lectures on recent work in physiology, neurology and optics; with surgical demonstrations, clinical and laboratory work.

The fee for the course is 300 francs. Further information can be obtained from Professor Terrien.

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Dental Note

WE are asked by Mr. A. M. Nodine, L.D.S. (Eng.), of 117, The Ridgeway, Wimbledon, S.W.19, to say that he will be grateful for clinical information, X-ray films, drawings and diagrams concerning aberrant teeth, in connexion with an article on this subject of which he is a joint author.

FUTURE ARRANGEMENTS

1934

March 9.—Section of Ophthalmology, Royal Society of Medicine. (Clinical Meeting.)

March 16.—North of England Ophthalmological Society, at Liverpool.

April 12-14.—Ophthalmological Society of the United Kingdom, Annual Congress, at the Royal Society of Medicine.

April 13.—North of England Ophthalmological Society, at Sheffield.

May 11.—Joint Meeting of the Midland and North of England Ophthalmological Societies, at Nottingham.

May 14.—Société française d'ophtalmologie, at the Hotel Majestic, Paris.

May 14.—International Ophthalmological Council, at Paris.

May 14.—Committee of the International League against Trachoma and the International Association for the Prevention of Blindness, combined meeting.

June 5.—Midland Ophthalmological Society, at Northampton.

June 8.—Section of Ophthalmology, Royal Society of Medicine. (Annual.)

July 4-7.—Oxford Ophthalmological Congress, at Oxford.

October 2.—Midland Ophthalmological Society, at Birmingham. (Annual Meeting)

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *January, 1934.*

WALKER. Retinal detachment.
HARDY, G. and HARDY, W. F. Preliminary report on orbital tumours.
BERNER. Conical cornea complicated by acute ectasia.
DAVIS. Keratitis bullosa.
FERREE and RAND. The testing of visual acuity.
GOWEN. Source of staphylococci on normal conjunctiva of human eye.
HILDRETH. The mechanism of the cross cylinder.
TOOKER. Epithelial cyst in the posterior chamber.
CHANCE. Sarcoma of choroid in a shrunken globe exhibiting fibrous formation about the tumour.

Archives of Ophthalmology. *January, 1934.*

ADLER. Problems in the physiology of the visual acuity.
BARKAN. Bilateral glioma treated by radium.
BENEDICT. Excision of corneal leukoma.
COLEMAN and HILL. Cyst of the optic nerves and chiasm associated with an epithelioma of Rathke's pouch.
DUKE-ELDER, SIR STEWART and LADY. Aetiology of glaucoma.
ELLETT. Cataract and tetany following parathyroid disturbance.
ELSCHNIG. Intra-capsular extraction in highly myopic eyes.
FRIEDENWALD. The first medical refractionists.
GIFFORD and BARTH. Visual sensation produced by Roentgen and radium rays.
GRADLE. Rupture of the sphincteral portion of the iris produced by blunt trauma.
DE GROZ. Extraction of cataracts.
VAN DER HOEVE. Scleromalacia perforans.
IGERSHEIMER. Pathology of tuberculosis of the anterior uvea.
JACKSON. Cycloplegia for diagnosis.
KNAPP. Xanthomatosis of the orbit: report of two cases.
LINDNER. Prevention of spontaneous retinal detachment.
MAGITOT. The sub-retinal fluid in idiopathic detachment of the retina.
MANN. Persistence of capsulopupillary vessels as a factor in the production of abnormalities of the iris and lens.
PARKER. Comparative results in the extraction of senile cataracts using the combined, simple and Knapp-Török intra-capsular methods.
POST. Laevo-glaukosan and epinephrine bitartrate in the treatment of glaucoma.
DE SCHWEINITZ and DE LONG. Blindness and papilloedema in Guernsey calves.
WHEELER Schuller-Christian disease (Xanthomatosis) report of a case with post-mortem observations.

Annales d'Oculistique. *January, 1934.*

WEVE. Technique of the method of diathermy for the treatment of retinal detachment.
DOR. Choroidal detachment, post-operative or spontaneous. Its possible confusion with sarcoma.
TERSON. Treatment of the eczemas of the eyelids.
GABRIÉLIDÈS. Histological and microbiological study of the concretions of leprous episcleritis.

Archives d'Ophtalmologie. *January, 1934.*

BONNET and PAUFIQUE. Traumatic cysts of the iris.
TISSOT-DAGUETTE. Visual troubles after the injection of acetylarsan.
HUDELO. Astigmatism after the operation for chalazion.
GEORGARIOU. A case of acute mycosis of the orbit.

Revue d'Oto-Neuro-Ophtalmologie. *November, 1933.*

PUECH, DAVID and BRUN. Contribution to the study of optic-chiasmic arachnoiditis.
WINTER, RAPPOPORT and BERDET. Three cases of arachnoiditis of the posterior fossa.

Klinische Monatsblätter für Augenheilkunde. *December, 1933.*

VOGT. Furnace cataract.
JUNIUS. On the question of angiomatosis retinae.
FRIEDE. The variability of size of the central and peripheral surface of refraction of normal cornea and the relation of these in micro- and megalocornea.
GROSSGEBAUER. Multiple epitheliomata of the eyes and adnexa.
KLEIN and STEIN. Hemianopic hallucinations.
BEZECNY and ST. BIERINGER. The histology of conjunctival disease in summer prurigo.
TÓTH and MESZÁROS. Optic atrophy with an angio-spastic foundation.
VOGT. Correction.

January, 1934.

BIELSCHOWSKY. Combination of functional (psychological) and organic disease of the ocular movements.
——— Exophoria and excessive divergence.
WAARDENBURG. A remarkable combination of congenital deformities: bilateral hydrophthalmos combined with acrocephalosyndactyly, cardiac defect, pseudo-hermaphrodism and other anomalies.
VON SZILY. Experimental investigations on bipolar superficial electrolysis as a method of treatment for retinal detachment.
PFLIMLIN. Participation of the eyes in caisson disease, in particular the development of cataract.
POOS. Clinical observations on vaso-motor hemicrania with degeneration of the region of the organs of vision.
KUNZ. The effect of vitamin A preparations in a case of keratomalacia.
SALUS. Congenital retraction of the eyeballs.
LÖWENSTEIN. Implantation of prepared grafts after excision of the eyeballs.
SPINELLI. Micrometry of the fundus, determination and scleral localization of corresponding retinal points, effected by special additional parts to the simple Gullstrand ophthalmoscope.
ISAKOWITZ. Localization perimetry.

Annali di Ottalmologia e Clinica Oculistica. *November, 1933.*

CORRADO. End results of Roentgen therapy treatment of sellar and parasellar tumours.
GIANNANTONI and POSSENTI. Ocular symptoms of pulmonary tuberculosis.

Bollettino d'Oculistica. *November, 1933.*

MOTOLESE. Surgical treatment in high myopia.
BRANA and SCHIFF. The importance of intelligent ophthalmoscopy in arteriosclerosis and in essential hypertonia.
BIOZZI. Knapp's angioid streaks.
SALA. The depth of the anterior chamber in living eyes in relation to age and to the state of ocular refraction.
VILLANI. On a particular degenerative condition of the cornea found in three cases of atypical familial amaurotic idiocy.
VELE. The behaviour of corneal astigmatism inversely with age and in myopia.

December, 1933.

CARAMAZZA. Adhesive chorio-retinitis from dia-scleral and trans-scleral diathermy coagulation.
BIETTI. Research on the variations of temperature in any zone of the globe from episcleral diathermic coagulation, thermocauterization and the appliance of chemical caustics
VELE. Biomicroscopical aspect of trachomatous corneal pannus.
SANTONI. Experimental research on the possibility of introducing neosalvarsan into the ocular tissues by means of iontophoresis.

Rassegna Italiana d'Ottalmologia.

GALEAZZI. Cataract and calcium-potassium equilibrium.
CROCI. Experimental adhesive chorio-retinitis.
SABBADINI. Hares eyes. Experimental research on transmissibility to rabbits.
D'ASARO BIONDO. Ocular lesions from vegetable tar.
VITA. Considerations and research on the retina in anisometropia.
BERTOLDI. Contribution to the knowledge of meibomian neoplasms.
PERGOLA. A case of coloboma of the optic nerve.
GALLENGA. Biomicroscopical observations of congenital partial biphakia.

Archivos de Oftalmologia Hispano-Americanos. *January, 1934.*

MOREU and PRIOR. Diagnosis and treatment of parenchymatous tuberculous keratitis.

Revista Oto-Neuro-Oftalmologica. *November, 1933.*

FRANCESCHETTI. Corneal sensibility.
PAVIA. The correction of squint with the miocampter.
PAVIA and DURANDO. Sub-retinal cysticercus.
DUSSELDORP and RIVOLTA. Variations of tension in the central retinal artery.
PAVIA. Practical and rational classification of the causes of blindness.

Revista Oto-Neuro-Oftalmologica. *December, 1933.*

HALBERTSMA. Case of primary carcinoma of the lacrymal sac.
PAVIA and REPETTO. Ocular paralysis of the levator. Disappearance of papill-oedema by deep radiotherapy.
PAVIA. Compulsory declaration of blindness.
——— Visual examinations in the schools of Buenos Aires.
PAVIA and DUSSELDORP. The National Institute of Trachoma.

Revista Cubana de Oto-Neuro-Oftalmiatria.

September-October, 1933.

CAMISÓN. A case of the pseudo-sign of Graefe.
AVALOS. Retrospective diagnosis of a case of ocular hysteria.
GARCIA and CÉSPEDES. The actual position of surgical diathermy in ophthalmology.
LLORCA. The treatment of trachoma by the instillation of autovaccines.

Revista Oto-Neuro-Oftalmologica y de Cirugia Neurologia.

February, 1934.

PAVIA and DUSSELDORP. Soemmering's ring and traumatic aniridia.
ENDERLE. Sella turcica. New method of graphical measurement and valuation.